EVALUATING DETERMINANTS OF STICKY COSTS AND OPERATIONS BASED EARNINGS PREDICTION MODELS USING AIR TRANSPORTATION INDUSTRY DATA AND VALIDATION OF VERIFIABLE DETAIL AS A SOURCE OF CREDIBILITY IN CUSTOMER RETENTION STRATEGY DISCLOSURE

by

James Nibley Cannon

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STATEMENT OF DISSERTATION APPROVAL

The dissertation of **James Nibley Cannon**

has been approved by the following supervisory committee members:

Taylor Randall	, Chair	**6/13/2011** Date Approved
Rachel Hayes	, Member	**6/7/2011** Date Approved
David Plumlee	, Member	**6/7/2011** Date Approved
Brian Cadman	, Member	**6/8/2011** Date Approved
Krishnan Anand	, Member	**6/7/2011** Date Approved

and by **William Hesterly** , Associate Dean of the **David Eccles School of Business**

and by Charles A. Wight, Dean of The Graduate School.

ABSTRACT

Chapter 1 examines the relevance of operations based variables predicting future earnings. We use United States Air Transportation (airline) industry data to identify operations based variables that provide predictive information beyond that found in earnings components. We show that the adjusted *R*-squared from accounting based prediction models can be increased up to 5.1 percentage points by including operations based variables. We also find that predictive information found in operations based variables is not fully impounded in financial analysts' earnings predictions. We show that operations based variables explain 7.7 percentage points of analyst forecast error. We observe that this effect is especially large after the terroristic attacks of September 11, 2001 suggesting analysts continued using historical prediction methods, even though the airline industry went through dramatic turmoil.

Chapter 2 examines determinants of sticky cost behavior (asymmetric cost changes as revenue fluctuates). Cost accounting researchers examine sticky cost behavior to gain insights about management capacity decisions. The majority of the extant literature infers that costs decrease slower than they increase with demand fluctuations because management retains unused capacity in anticipation of future demand

resurgence. I use airline industry data to provide evidence that sticky costs are associated with capacity and output selling price changes as management matches capacity with sales volume. I conclude that sticky costs arise when management adjusts capacity and sales volume (through pricing) if marginal cost of adding capacity is increasing as demand grows and marginal benefit from reducing capacity is decreasing as demand falls.

There is a lack of research investigating sources of credibility in nonfinancial disclosures. This is likely due to difficulty in associating expected future performance with nonfinancial variables. Chapter 3 addresses the problem using customer retention strategy disclosures. Customer retention theory provides expectations regarding economic outcome which can be used to validate sources of credibility in nonfinancial disclosure. I find that firms that provide verifiable detail in their customer retention disclosure increase the persistence of positive abnormal performance relative to firms that do not. This result contributes by providing evidence that verifiable detail is a valid source of credibility in nonfinancial disclosure.

This dissertation is dedicated to my family, Michelle, Mikaela, Andrew, Rylee, Tayler, Camryn, and Cosette, whose support allowed me to pursue my dreams.

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INTRODUCTION

My dissertation is a compilation of three stand-alone papers. The first paper (Chapter 1), co-authored with Taylor Randall and Christian Terwiesch, examines the predictive associations between operations based variables and future earnings using data from the United States Air Transportation industry. We find that some of the predictive information conveyed by operations based variables is incremental to that conveyed by earnings components. We also find that financial analysts do not fully impound the information provided by operations based variables. Finally, we observe that this effect is especially prevalent following the terroristic attacks of September 11, 2001.

The second paper (Chapter 2) uses United States Air Transportation industry data to identify determinants of sticky cost behavior (asymmetric cost changes as revenue increases and decreases). I provide evidence that sticky costs arise when managers incur increasing marginal cost and decreasing marginal benefit as they adjust capacity. I also provide evidence that sticky costs arise when managers adjust sales volume through output selling price changes. These determinants add to the prevalent explanation offered by the extant literature that sticky costs arise from managers' retention of unused resources as demand falls.

The third paper (Chapter 3) identifies verifiable detail as a valid source of credibility in nonfinancial strategy disclosure. Specifically, I use customer retention theory to form expectations regarding outcome associated with credible customer retention strategy disclosure. I find that ex post outcome of firms that provide verifiable detail in their disclosures is more consistent with theory than outcome of firms that do not. This result provides evidence that verifiable detail is a valid source of credibility in customer retention strategy disclosure.

CHAPTER 1

EVALUATING OPERATIONS BASED DATA IN EARNINGS PREDICTION: A STUDY OF THE UNITED STATES AIRLINE INDUSTRY

Introduction

The prediction of future earnings is one of the most important tasks for investors in publicly traded companies. Firm valuation and the stock price of a company are determined based on future expected earnings (e.g., Copeland, Koller, McKinsey and Company & Murrin, 2000; Ohlson, 1995). Sophisticated investors spend a significant amount of resources building statistical models to predict future earnings for a specific company (Lundholm & Sloan, 2004). Earnings prediction models used by professional investors are typically built for a specific industry and often make extensive use of operations based variables. For example, the Standard and Poor's guide (2005) on how to analyze an airline includes 10 pages explaining various operational details specific to the airline industry. However, academic research investigating the predictive qualities and analyst use of operations based variables has been limited (Abarbanell, 1991; Abarbanell

& Bushee, 1997). Our research objective is to investigate if operations based variables can help in the prediction of future earnings and to analyze to what extent operations based variables are used by professional analysts in their creation of earnings predictions.

While the earnings component variables discussed in the accounting literature are universally applicable across a broad range of industries, this is not the case for operations based variables. It lies in the nature of operations based variables that they are industry specific. Hence, to make the case that operations based variables carry predictive power, we have to pick a specific industry for our empirical analysis. We found that the United States Air Transportation (airline) industry provides an interesting research setting given our research objective. Due to regulation, the industry provides a detailed set of well-defined operations based variables that are publicly available and can be compared across airlines and over a long time horizon. Moreover, the industry is predominantly comprised of publicly traded firms which have experienced substantial variation in performance.

In the context of the airline industry, we empirically analyze the relationship between a set of operations based variables, earnings predictions made by professional analysts, and realized financial performance. This allows us make the following three contributions.

First, we show that operations based variables significantly increase the predictive power of earnings prediction models beyond that provided by accounting variables. Specifically, we show that the adjusted *R*-squared obtained from using

traditional accounting models can be increased by 5.1 percentage points, from 71.2% to 76.3% with the inclusion of operations based variables. This extends prior research in Operations Management that has established a link between operations based variables and *contemporary* (same period) financial performance (see Lapre & Tsikriktis, 2006 and Tsikriktsis, 2007 as examples) by showing that operations based variables can also serve as predictors of *future* financial performance.

Second, we show that the predictive information found in these operations based variables is not fully impounded in analyst forecasts. When looking over the entire time period from 1993 to 2007 we find that these operations based variables explain up to an additional 7.8 percentage points, from 31.0% to 38.8%, of consensus analyst forecast error beyond earnings components, year, quarter and firm effects alone. This extends prior accounting research that has examined analyst forecast error (Abarbanell, 1991; Abarbanell & Bushee, 1997; O'Brien, 1988) by demonstrating that analysts do not fully incorporate relevant operational information in their forecasts.

Third, we examine the impact of the terroristic attacks of September 11, 2001 and the subsequent turmoil in the airline industry on both the predictive power and the analysts' use of operations based variables. We show that operations based variables *do not* predict analyst forecast error in the years prior to September 11, 2011 but *do* predict analyst forecast error afterwards. This suggests that the financial value drivers in the airline industry changed as a result of the turmoil and analysts could have improved their forecast accuracy by looking at operational variables instead of relying on the prediction methods that had been developed and calibrated under very different industry conditions.

The remainder of the chapter is organized as follows: Section 1.2 provides a

review of the relevant literature. Section 1.3 develops the theory and econometric framework for identifying relationships between operations based variables and future earnings. Section 1.3 also includes a discussion of the relationship between information and analyst forecast error. Section 1.4 describes how our theory and methods are applied in the airline industry. Section 1.5 discusses results and analysis. Finally, Section 1.6 provides a conclusion and future research direction.

Prior Literature

Several studies in Operations Management have analyzed the relationship between operations based variables and contemporary financial performance. Interestingly, most of these studies have been conducted in the airline industry, including Haunschild and Sullivan (2002); Lapre and Scudder (2004); Luo (2007); Rothstein (1971); Subramanian, Stidham and Lautenbacher (1999); You (1999); and Zhao and Zheng (2001). Tsikriktsis (2007) provides the most recent work in this area, investigating the contemporary association between operational efficiency and earnings (e.g., the effect of fleet utilization in period *t* on earnings in period *t*). This line of work endows us with econometric models of the relationship between operations based variables and accounting variables. Specifically, we use the variables defined by Lapre and Scudder (2004) as the foundation for constructing our set of operations-based variables.

The central difference between our work and prior studies in Operations Management is that we do not use operations based variables to explain *contemporary* (same period) financial performance but instead use operations based variables to predict *future* (next period) financial performance. Thus, our data set and variable definitions

might look similar to prior empirical studies of airline operations, yet our theoretical approach (and consequently our econometric models) is rather different.

Earnings prediction models in the Accounting literature establish a correlation between contemporary accounting and future earnings information (e.g., the effect of margins in period *t* on earnings in period *t+1*). For example, it has been well-documented that stock prices contain leading information about future earnings (Beaver, Lambert, & Morse, 1980, Beaver, Lambert, & Ryan, 1987; Collins, Kothari, & Rayburn, 1987; Freeman, 1987). Additionally, Beaver and Morse (1978) show that price/earnings ratios have predictive quality with respect to future earnings. The relationship between current earnings and firm value (commonly considered a function of expected future earnings, Feltham & Ohlson, 1995) has been referred to as an earnings capitalization multiplier or earnings response coefficient. Early research (Easton & Zmijewski, 1989 and Kormendi & Lipe, 1987) characterizes earnings response coefficients as firm-specific parameters that describe a stream of future earnings implicit in current earnings.

Later research (Penman, 1992) shows that earnings response coefficients are not fixed, but variable over time. Therefore, earnings response coefficients do not effectively represent *future* earnings streams because they may only be calculated *ex-post*. Ou and Penman (1989) utilize a statistical approach to reduce 68 prior and contemporaneous accounting measures to 28 that are significant in calculating earnings response coefficients. Fairfield, Sweeney and Yohn (1996) investigate the incremental information content found through disaggregation of accounting earnings. They find that disaggregation provides incremental explanatory power in explaining variance in future earnings (ROE), isolating earnings components based on differential persistence. Further,

they find that forecast errors decrease with disaggregation. Disaggregation also is the central idea behind the studies of Banker and Johnston (1993) and Ittner and Larcker (1998). Both of these studies use nonfinancial data to explain earnings. Banker and Johnston (1993) use the airline industry to demonstrate the importance of operations based variables as cost drivers. Ittner and Larcker (1998) demonstrate the importance of customer satisfaction as a driver of various firm level performance measures ranging from new customer acquisition to earnings.

In addition to predicting future earnings, accounting research has also analyzed the information content of analyst forecasts. Brown, Hagerman, Griffin and Zmijewski (1987) find that analyst forecasts are more accurate than time-series earnings models in predicting quarterly earnings both due to timing and better utilization of available information. Lang and Lundholm (1996) show that analysts perform the role of an information intermediary by processing and interpreting firm-disclosed information. O'Brien (1988) finds a systematic bias in analyst forecasts. Abarbanell (1991) finds that analyst forecasts generally reflect analyst optimism (forecasts that are too high) and that analysts appear to conservatively (partially) adjust their forecasts for changes in stock price. Lundholm and McVay (2006) develop a forecasting model using store growth in the retail industry that performs better than analyst forecasts. Finally, most similar to our results, Abarbanell (1991) and Abarbanell and Bushee (1997) find several accounting and efficiency variables (stock price, inventory, gross margin, earnings quality, labor force efficiency) are correlated with analyst forecast errors.

Closest to our study is the work by Gaur, Fisher and Raman (2005) and Luo (2007). Using financial statements, Gaur et al. analyze the relationship between inventory

and firm value in the retail sector. Similarly, Luo studies the association between consumer complaints and firm value in the airline industry. Since firm value is based on expected future earnings (Feltham & Ohlson, 1995), this work can conceptually be thought of as an earnings prediction model based on operational data. Our work, like the studies by Gaur et al. (2005) and Luo (2007), is at the interface between Operations Management and Accounting. Yet, it is unique in the level of detail in the definition of operational variables, which goes well beyond what is reported in financial statements, and our analysis of how analysts use such operational data when creating earnings predictions.

Theory Development

Our objective is to predict future (period *t*) earnings based on any currently (up to period *t-1*) available information. Let $\hat{E}_t$ represent the predicted earnings for period *t* and let $Information_{t-1}$ represent all information available in the prior period. Our objective is to create a predictive model:

$$\hat{E}_t = f\left(Information_{t-1}\right) \tag{1.1}$$

We can distinguish between two types of prediction models depending on the type of variables included in $Information_{t-1}$. First, an earnings components model uses information about last period's earnings to forecast subsequent earnings. Earnings components models have been extensively used in the Accounting literature (Abarbanell & Bushee, 1997; Dechow, 1994; Fairfield et al., 1996; Lev & Thiagarajan, 1993; Ou &

Penman, 1989). This line of literature suggests disaggregating earnings into operating and nonoperating earnings and then predicting earnings based on:

$$\hat{E}_t = \alpha_0 + \alpha_1 OpInc_{t-1} + \alpha_2 NonopInc_{t-1} \quad (1.2)$$

where $OpInc_{t-1}$ and $NonopInc_{t-1}$ represent actual operating and nonoperating earnings at time *t-1* and the coefficients capture the degree of earnings persistency. Similarly, we can predict a change in earnings in a particular quarter relative to the same quarter 12 months ago based on information how the previous quarter changed relative to the quarter that preceded it by 12 months:

$$\Delta\hat{E}_t = \eta_0 + \eta_1 \Delta OpInc_{t-1} + \eta_2 \Delta NonopInc_{t-1} \quad (1.3)$$

where the Δx_t represents the difference between the value of a variable *x* in period *t* and the value of *x* in the same quarter 1 year ago.

Beyond the earnings components model, we can introduce a set of operations based variables to supplement equations 1.2 and 1.3. Such operations based prediction models can be written as:

$$\hat{E}_t = \beta_0 + \beta_1 OpInc_{t-1} + \beta_2 NonopInc_{t-1} + \sum_1^M \phi_m * OV_{m,t-1} \quad (1.4)$$

$$\Delta\hat{E}_t = \theta_0 + \theta_1 \Delta OpInc_{t-1} + \theta_2 \Delta NonopInc_{t-1} + \sum_1^M \varphi_m * \Delta OV_{m,t-1} \quad (1.5)$$

where *OV* represents a matrix of *M* operations based variables for each of the time

periods.

To empirically assess the explanatory power of operations variables relative to accounting variables, we estimate the following two linear models based on equations 1.4 and 1.5:

$$E_t = \beta_0 + \beta_1 OpInc_{t-1} + \beta_2 NonopInc_{t-1} + \sum_1^M \phi_m * OV_{m,t-1} + \varepsilon_t \quad (1.6)$$

$$\Delta E_t = \theta_0 + \theta_1 \Delta OpInc_{t-1} + \theta_2 \Delta NonopInc_{t-1} + \sum_1^M \varphi_m * \Delta OV_{m,t-1} + \nu_t \quad (1.7)$$

In order to demonstrate that operations based variables have predictive power beyond what is captured in accounting variables, we need to demonstrate that the variables in *OV* (ΔOV) collectively increase the explanatory power of the regression model. Thus, our hypothesis test is based on demonstrating that the change in *R*-squared from the regression model without the variables contained in *OV* to the regression model that includes the variables in *OV* is statistically different (larger than) zero.

Next, consider the relationship between operations based variables and analyst forecasts. Analyzing historical forecasts and the associated forecast errors reveals insights about the information used in the underlying forecasting process. The relationship between earnings forecasts, information and future earnings can be written as:

$$E_t = AF_t + FE_t \quad (1.8)$$

where AF_t represents an analyst forecast for earnings at period *t* and FE_t is the forecast

error at period *t*. The forecast error can take on positive or negative values.

A systematic bias unassociated with the prediction model will manifest itself in systematic forecast error. For example, optimism (systematically high analyst forecasts) will manifest itself in low (negative) forecast errors (Abarbanell, 1991). Although we recognize and allow our model to capture (as an intercept) systematic analyst bias that is unrelated to information, this is not the main focus of our work. Instead, our goal is to show that some of the variance in the realized values of forecast errors can be explained using operations based variables.

The following regression model represents an econometric specification that allows us to assess the incremental explanatory power of operations based variables when explaining analyst forecast error:

$$FE_t = \gamma_0 + \gamma_1 OpInc_{t-1} + \gamma_1 NonopInc_{t-1} + \sum_1^M \lambda_m * OV_{m,t-1} + \upsilon_t \qquad (1.9)$$

$$FE_t = \psi_0 + \psi_1 \Delta OpInc_{t-1} + \psi_2 \Delta NonopInc_{t-1} + \sum_1^M \xi_m * \Delta OV_{m,t-1} + \omega_t \qquad (1.10)$$

The above equations are to be estimated taking into account temporal and firm effects (omitted from the equations for exposition). Just as in the case of earnings prediction models, an increase in the explanatory power brought along by the operations based variables implies that analysts are not fully impounding all of the available operations based information.

Industry Background and Implementation

Our sample is comprised of quarterly observations taken from nine airlines across 15 years. Our sample includes American Airlines, Delta Airlines, United Airlines, America West Airlines, Southwest Airlines, US Airways, Continental Airlines, Northwest Airlines and Alaska Airlines. Some airlines, most notably Southwest, have flourished while most (American, Delta, United, America West, US Airways, Continental and Northwest) have struggled repeatedly and have seen more losses than profits over the period of our study.

Northwest Airlines does not have financial data available in 1993-1994 and US Airways and America West Airlines merge effective the third quarter of 2005. These missing airline-quarters, together with 1 lagged quarter, leave an initial sample size of 512 airline-quarters. In this initial sample, we identified 18 outliers. These observations repeatedly showed up as outliers across regression models (studentized residuals less than -3 and greater than 3) and so we conducted a detailed, case-by-case analysis for each of them. As a result of this case-by-case analysis, we removed three outliers associated with bankruptcy-related extraordinary items in quarters Q405, Q106 and Q107 for Delta Airlines and one outlier associated with anomalous extraordinary operating items for United in Q103. Additionally, we removed seven outliers associated with anomalous changes in nonoperating expense (five outliers associated with anomalous changes in nonoperating expense in Northwest Airlines in quarters Q305 through Q206 and Q107 and two outliers associated with an anomalous change in nonoperating expense in Continental Airlines in quarters Q393 and Q493). We also removed two observations

associated with changes from large tax credits to no tax expense/credit due to abnormally large net deferred tax assets for United Airlines and American Airlines (Q402). We retained five additional outliers that represent significant changes in operating performance with no evidence of anomalous accounting issues. This led to a sample of 499 usable earnings prediction observations. Eighty-five of these observations are missing analyst forecasts (constrained by available information timing), leaving 414 usable forecast error observations.

We computed all accounting variables using quarterly United States Securities and Exchange Commission (SEC) filings. In addition, we computed our operations based variables using information from quarterly SEC filings, the monthly Air Travel Consumer Report (ATCR) issued by the United States Department of Transportation and the Transtats database offered by the Bureau of Transportation Services.

Consistent with prior forecast error research (Brown, Foster & Noreen, 1984; Elton, Gruber & Gultekin, 1981; O'Brien, 1988), we used IBES consensus median forecast errors.[1] Specifically, we used forecasts issued after the SEC filing and ATCR are released for prior quarter results (see Figure 1.1).

The earnings components models (equations 1.3 and 1.4) parse net income into operating and nonoperating income due to differential persistence (Fairfield et al., 1996). The operations models (equations 1.5 and 1.6) supplement earnings components with

[1] We repeat all our analysis (unreported) using mean forecast errors and find (consistent with O'Brien, 1988) a larger degree of bias and forecast error. We also reconcile quarterly net income to match IBES-reported net earnings to ensure comparability between IBES analyst forecasts and net income. Additionally, IBES analyst forecasts and net earnings are typically adjusted for nonrecurring items. This adjusts for systematic differences in quarterly net income due to GAAP fiscal year-end adjustments.

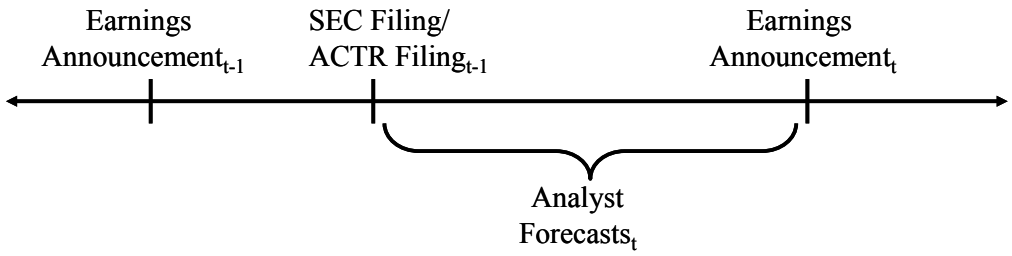

Figure 1.1

Timeline of Events

operations based variables.[2]

The first two operations based variables, aircraft load factor (the percentage of seat miles that an airline obtains revenues for, RPM/ASM) and airtime, measure the aircraft efficiency. Efficiency (also called utilization and productivity) has been positively associated with contemporaneous earnings (Lapre & Scudder, 2004; Tsikriktsis, 2007). Similarly, we expect changes in efficiency to be positively associated with changes in future earnings.

The airline industry provides several measures of service quality including consumer complaints, on-time arrival performance, involuntary denied boarding and mishandled baggage.[3,4] Service quality has a rich history of positive association with firm performance (Ittner & Larcker, 1998; Luo, 2007; Tsikriktsis, 2007). Some of the positive

[2] The functional form for the earnings component model is based on a simple random walk. In contrast, the exact functional form for the operations model is not theoretically specified and is assumed to be linear. We ran various time-horizon moving average operations based variable models as well. The specific results differ slightly from model to model. However, our conclusions that 1) operations based variables provide predictive power and 2) the variables that matter change with the 9/11 industry shock remain robust.

[3] We recognize that there are limitations to using on-time arrival performance as a measure of service quality. For example, we make an implicit assumption about passengers' ex ante expectations (that a flight will arrive on-time), we introduce noise associated with exogenous seasonal factors such as weather (partially captured by our temporal control variables), we submit ourselves to potential self-report bias, and

benefits come after adverse performance due to initial cost outlays (Lapre & Scudder, 2004). Similarly, we expect that changes in service quality will have a positive association with changes in future earnings.

We use on-time arrival performance as a measure of service quality as it is available by flight and booking airline. This becomes increasingly important over the sample period as major airlines provide an increasing number of flights through regional subsidiaries and/or engage in capacity purchase agreements with independent regional carriers. We measure on-time arrival performance as the flight-weighted average of all wholly-owned subsidiaries and airline-booked flights (to capture capacity purchase agreements).

The next two operations based variables, Fleet and Airport Concentration, measure operational focus (Lapre & Scudder, 2004; Lapre & Tsikriktsis, 2006; Tsikriktsis, 2007) and purchasing/pricing market power (Berry, 1990; Borenstein, 1989; Evans & Kessides, 1993; Gimeno & Woo, 1999). We expect that changes in operational focus are positively associated with changes in future earnings.

The final two operations based variables represent an airline's structural choices in operations. Flight Length and Seats/Aircraft measure components of route and fleet structure found to be associated with flight cost behavior and fuel efficiency (Baltagi,

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ignore other sources of service quality (Lapre & Scudder, 2004). We compare results using consumer complaints, involuntary overbooking and mishandled baggage for a subsample (see footnote 4).

[4] We substitute Consumer Complaints, Involuntary Overbooking and Mishandled Baggage using 1997-2007 data. We find that changes in Consumer Complaints predict future earnings pre-9/11 while the level of Consumer Complaints predicts future earnings post-9/11 tragedy. Neither changes nor the level of Involuntary Overbooking predicts future earnings. Interestingly, changes in Mishandled Baggage have a negative relationship with changes in future earnings pre-9/11 and a positive relationship with changes in future earnings post-9/11 tragedy. In summary, with the exception of Involuntary Overbooking, all service quality measures have predictive relationships with future earnings that change with the 9/11 tragedy industry shock.

Griffin & Rich, 1995; Borenstein, 1989). Specifically, costs are found to be increasing at a decreasing rate in Flight Length. We expect similar increasing returns to scale with aircraft size (Seats/Aircraft). As a result, we expect that changes in our structural variables are positively associated with changes in future earnings.

Table 1.1 provides descriptive statistics and precise definitions for each variable in our study. In many cases, we normalize each variable by the number of available seat miles for each airline. Normalizing by ASM is the standard industry convention for comparing data between airlines.

Our second set of tests use operations based variables (in combination with earnings components) to predict analyst forecast errors (equations 1.9 and 1.10). As mentioned above, temporal (quarter and year) and firm effects provide a natural benchmark against which we can compare the explanatory power of various information sets. Additionally, we include earnings components in our baseline model (Abarbanell, 1991; Abarbanell & Bushee, 1997). Significant improvements in explanatory power resulting from operations based variables imply that analysts are not fully impounding the available predictive information. Figure 1.2 shows the forecast errors over quarters in our sample. Note the exceptionally large forecast error in the quarter containing September 11, 2001 as well as the substantial increase in the average forecast error in the following quarters.

Our data structure is best described as a time-series cross-section dataset. Our airlines provide nine firms over which we measure from 46 (Northwest) to 59 useable observations (Southwest and Alaska airlines). We use three types of indicator variables to capture systematic correlations within the data (Petersen 2009). First, we control for

Table 1.1

Descriptive Statistics and Data Definitions

Variable (*N*=499)[1,2]	Description	Mean	Median	Std.	Min.	Max.
Dependent Variable						
Net Income / ASM	Net Income / ASM	0.04¢	0.18¢	0.71¢	(3.52¢)	1.31¢
Earnings Components						
Operating Income / ASM	Operating Income + Net Interest / ASM	0.18¢	0.31¢	0.99¢	(3.38¢)	2.46¢
Nonoperating Income / ASM	Nonoperating Income – Taxes / ASM	(0.09¢)	(0.08¢)	0.56¢	(5.96¢)	7.93¢
Efficiency						
RPM / ASM	(RPM / ASM) x 100%	71.0%	70.5%	5.9%	50.4%	86.4%
Airtime	Average airtime hours / aircraft[3]-day)	8.11	8.04	0.79	3.76	10.80
Service Quality						
On-Time Arrival	% on-time arrivals x 100%	79.0%	79.5%	5.1%	55.4%	94.3%
Focus						
Fleet Concentration	Herfindahl Concentration Index of Aircraft type	20.1%	14.9%	13.2%	9.3%	75.5%
Airport Concentration	Herfindahl Concentration Index of Airport departures	4.7%	3.9%	2.1%	2.4%	10.8%
Fleet/Flight Structure						
Flight Length	(ASM / flight) / (seats / aircraft[3])	666	675	160	331	978
Seats / Aircraft	Average seats / aircraft[3]	141	135	22	95	196

[1] Throughout the sample time period, major airlines added and divested subsidiary airlines and engaged in capacity purchase agreements. Subsidiary and capacity purchase agreement operations data, when available, was added to major airlines for all quarters in which subsidiary and capacity purchase agreement accounting performance was reflected in consolidated numbers to enhance comparability.

[2] Net Income and related earnings components were hand-collected from SEC filings and were reconciled to match IBES reported actual net income. Operations-based data is collected from SEC filings, monthly Air Travel Consumer Report (ATCR) issued by the U.S. Department of Transportation, and the Transtats database offered by the Bureau of Transportation Services.

[3] Aircraft include all operating aircraft

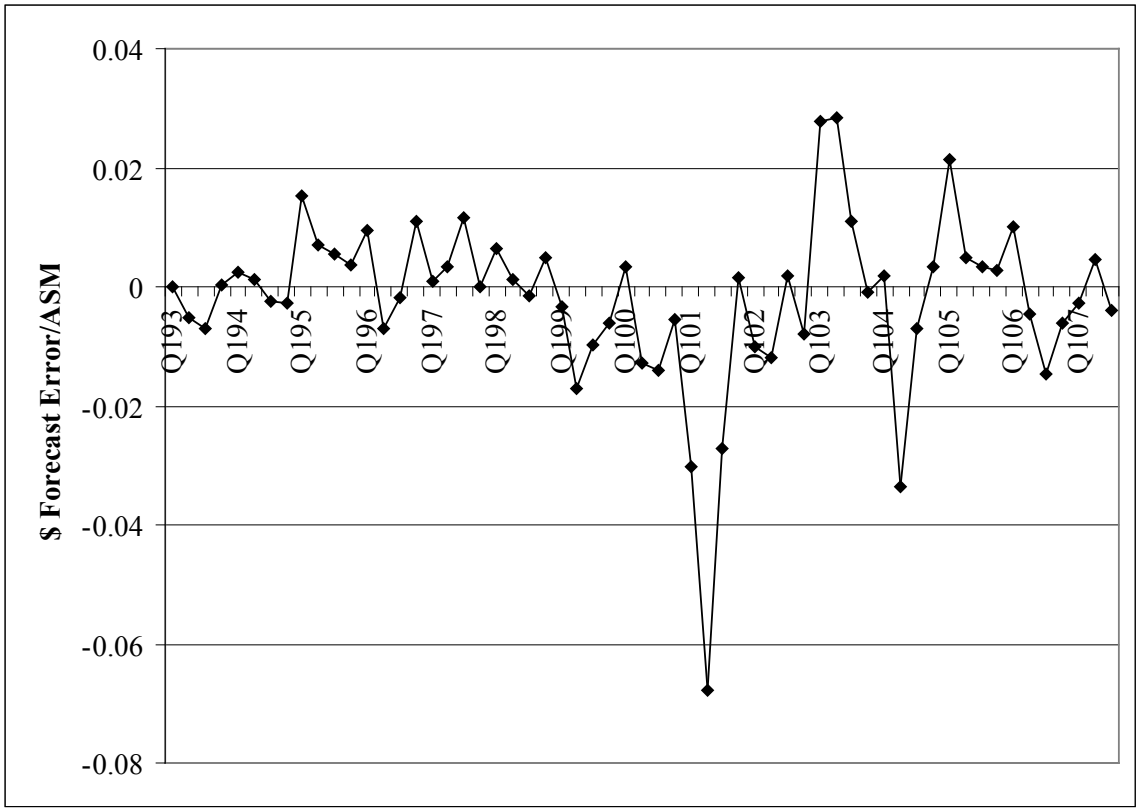

Figure 1.2

$ Forecast Error per ASM by Quarter

cross-sectional correlation (temporal effects that impact all firms) by including year dummy variables. Second, we control for quarterly seasonality effects by including quarter dummy variables in the levels model and use seasonal changes (i.e., 1st quarter 2007 – 1st quarter 2006) in the changes model. Finally, we control for firm fixed effects (systematic differences between firms over time) by including firm dummy variables. Additionally, we use panel-corrected standard errors (Beck & Katz 1995, Beck 2001, Lapre & Tsikriktsis 2006, Petersen, 2009) to correct for cross-sectional and autoregressive correlation in standard errors.

Results

Table 1.2 Panels A and B address the central question whether operations based variables contain incremental predictive information beyond that conveyed by the earnings components models (equation 1.6 and 1.7). The first column reports the significance (F-statistic) of the difference in R-squared between the earnings components model and the model including all operations based variables. The second column reports the significance of the difference in explanatory power for the subsample consisting of all quarters prior to September 11, 2001 while the third column reports this significance for all quarters after September 11, 2001.

Additionally, we test each operations based variable for incremental explanatory power. We do this in an effort to isolate which operations based variables provide incremental explanatory power in predicting future earnings and whether the industry shock associated with the September 11, 2001 tragedy impacts the predictive relevance of specific operations based variables. The results of these tests are reported in Table 1.2 Panels A and B, rows two through eight.

Consider the results for the levels model (equation 1.6) first. We observe that the added operations variables are highly significant in the regression model (p<0.001). Further, we observe that on-time arrival, the airport concentration, and the number of seats per aircraft are adding significant statistical power across the entire sample. This confirms the prior work on service quality by Lapre and Scudder (2004) as well as the importance of having a strong presence at some airports so to have a larger local pricing power (Berry, 1990; Borenstein, 1989; Evans & Kessides, 1993).

Table 1.2

Incremental Explanatory Power in Earnings Prediction

PANEL A – Levels Model

$$E_t = \beta_0 + \beta_1 OpInc_{t-1} + \beta_2 NonopInc_{t-1} + \sum_1^M \phi_m * OV_{m,t-1} + \varepsilon_t \quad (1.6)$$

DV = Net Income/ASM	**Full Sample (*N*=499)**	**Pre-9/11 Sample (*N*=296)**	**Post-9/11 Sample (*N*=185)**
F-statistic indicating significant incremental explanatory power			
All Operations Variables	11.68***	11.79***	4.72***
Efficiency:			
RPM/ASM	0.00	6.03*	0.00
Airtime	2.72	0.87	9.16**
Service Quality:			
On-Time Arrival	30.28***	43.18***	2.10
Focus:			
Fleet Concentration	1.99	0.00	8.63**
Airport Concentration	7.69**	3.10	0.24
Fleet/Flight Structure:			
Flight Length	1.44	0.63	1.69
# of Seats/Aircraft	4.54*	5.05*	0.00

PANEL B – Changes Model

$$\Delta E_t = \theta_0 + \theta_1 \Delta OpInc_{t-1} + \theta_2 \Delta NonopInc_{t-1} + \sum_1^M \varphi_m * \Delta OV_{m,t-1} + \nu_t \quad (1.7)$$

DV = Δ(Net Income/ASM)	**Full Sample (*N*=460)**	**Pre-9/11 Sample (*N*=258)**	**Post-9/11 Sample (*N*=150)**
All Operations Variables	5.64***	8.44***	2.92**
Efficiency:			
Δ(RPM/ASM)	0.00	0.19	0.05
Δ(Airtime)	6.13*	2.43	1.84
Service Quality:			
Δ(On-Time Arrival)	15.00***	37.68***	1.10
Focus:			
Δ(Fleet Concentration)	1.82	0.19	7.24**
Δ(Airport Concentration)	8.72**	6.02*	0.00
Fleet/Flight Structure:			
Δ(Flight Length)	0.43	4.14*	0.16
Δ(# of Seats/Aircraft)	6.93**	6.56*	5.90*

All variables are defined as in Table 1.1.
Each cell provides the *F*-statistic associated with the difference in explanatory power (*R*-squared) between models *with* and *without* the operations-based variable(s) that label each row. Panel A uses variations of equation 1.6 and Panel B uses variations of equation 1.7.
***, **, * significant at the $p<0.001$, 0.01 & 0.05 levels (2-sided).

It is interesting to compare the role of operations based variables in the two subsamples, quarters prior September 11, 2001 and quarters following September 11, 2001. In both subsamples, operations-based variables are collectively highly significant, as is indicated by the large *F*-statistic ($p<0.001$). However, it is interesting to observe that which operations based variables are driving earnings differs fundamentally between the two subsamples. Prior to September 11, 2001, aircraft load factor (RPM/ASM), on-time arrival and seats/aircraft (aircraft size) levels contain the significant incremental predictive information ($p<0.05$, $p<0.001$ and $p<0.05$, respectively).

In contrast, airtime and fleet concentration contain the significant incremental predictive information ($p<0.01$) in the quarters following September 11, 2001. This confirms that the events of September 11, 2001 have fundamentally altered the dynamics of the airline industry. While operations based variables are important before and after September 11, 2001, the importance shifted from service quality to focus and efficiency alone.

Next, consider the changes model. We again see a strong support for the significance of operations based variables. Just as in the levels model, we observe that the operations based variables that predict financial performance differ in the two subsamples. Changes in on-time arrival percentage, airport concentration and flight length provide incremental predictive information ($p<0.001$, $p<0.05$ and $p<0.05$ respectively) for the time up to September 11, 2001, while change in fleet concentration only becomes relevant ($p<0.01$) in the following quarters (Table 1.2 Panel B). Changes in seats/aircraft, on the other hand, is relevant ($p<0.05$) throughout the sample periods.

Based on the results shown in Table 1.2, we conclude that operations based

variables collectively help explain future earnings, yet the relative importance of the operations based variables is altered fundamentally after the industry turmoil following September 11, 2001.

Table 1.3 Panels A and B use levels and changes to examine the question whether analysts fully impound relevant operations based predictive information in their earnings forecasts. As a baseline, we establish a model that uses quarter, year and firm dummy variables and earnings components to measure temporal and firm-specific shocks while controlling for accounting information that might predict forecast error. We refer to this as the baseline model. We then examine whether operations based variables predict forecast error beyond that which is explained by the baseline model. The first column reports the significance (*F*-statistic) of the incremental explanatory power (difference in *R*-squared) provided by operations based variables using the full sample. Columns two and three repeat the analysis for the pre- and post- September 11, 2001 subsamples.

The first row reports the significance of the incremental explanatory power associated with operations based variables in aggregate. Rows two through eight report the incremental explanatory power of each operations based variable. We see that the full sample (first column) results are consistent whether using levels or changes. Operations based variables in aggregate explain a significant proportion of forecast error ($p<0.01$ or stronger). Specifically, on-time arrival and airport concentration are not fully impounded ($p<0.01$ or stronger).

It is interesting to note that operations based variables only predict forecast error after September 11, 2001. This suggests that analysts were completely utilizing operations based information prior to September 11, 2001. Yet, analysts failed to adjust

Table 1.3

Incremental Explanatory Power Predicting Analyst Forecast Error

PANEL A – Levels Model

$$FE_t = \gamma_0 + \gamma_1 OpInc_{t-1} + \gamma_1 NonopInc_{t-1} + \sum_1^M \lambda_m * OV_{m,t-1} + \upsilon_t \quad (1.9)$$

DV = Forecast Error/ASM	**Full Sample (*N*=414)**	**Pre-9/11 Sample (*N*=235)**	**Post-9/11 Sample (*N*=164)**
F-statistic indicating significant incremental explanatory power			
All Operational Variables	5.93***	1.25	2.82**
Efficiency:			
RPM/ASM	0.00	0.05	1.88
Airtime	0.54	0.00	2.73
Service Quality:			
On-Time Arrival	15.18***	3.54	4.90*
Focus:			
Fleet Concentration	3.38	1.92	4.14*
Airport Concentration	8.94**	1.87	0.22
Fleet/Flight Structure:			
Flight Length	3.26	1.55	2.27
# of Seats/Aircraft	0.06	0.05	4.42*

PANEL B – Changes Model

$$FE_t = \psi_0 + \psi_1 \Delta OpInc_{t-1} + \psi_2 \Delta NonopInc_{t-1} + \sum_1^M \xi_m * \Delta OV_{m,t-1} + \omega_t \quad (1.10)$$

DV = Forecast Error/ASM	**Full Sample (*N*=390)**	**Pre-9/11 Sample (*N*=211)**	**Post-9/11 Sample (*N*=132)**
All Operational Variables	3.51**	1.53	5.63***
Efficiency:			
Δ(RPM/ASM)	1.69	3.05	0.09
Δ(Airtime)	1.97	0.09	8.32**
Service Quality:			
Δ(On-Time Arrival)	10.02**	0.00	0.98
Focus:			
Δ(Fleet Concentration)	0.00	0.00	14.83***
Δ(Airport Concentration)	6.91**	3.33	2.26
Fleet/Flight Structure:			
Δ(Flight Length)	0.34	0.00	0.76
Δ(# of Seats/Aircraft)	0.51	2.63	1.41

All variables are defined as in Table 1.1.
Each cell provides the *F*-statistic associated with the difference in explanatory power (*R*-squared) between models *with* and *without* the operations-based variable(s) that label each row. Panel A uses variations of equation 1.9 and Panel B uses variations of equation 1.10.
***, **, * significant at the $p<0.001$, 0.01 & 0.05 levels.

their prediction models following the industry turmoil associated with the terroristic attacks. As a consequence, they failed to completely impound operations based information after September 11, 2001.

Specifically, analysts have not fully impounded the predictive information (unique to operations based variables) provided by changes in airtime ($p<0.01$), the level of on-time arrival ($p<0.05$), the level and change in fleet concentration ($p<0.05$ and $p<0.001$) and finally, the level of seats/aircraft ($p<0.05$).

This is consistent with the results shown earlier (Table 1.2) when we found that the levels of on-time arrival and seats/aircraft and level of and change in fleet concentration only provide incremental explanatory power in predicting future earnings for the subsample of quarters preceding September 11, 2001. It is possible that analysts kept using their prediction models that were fixated on the pre-9/11 period, emphasizing variables such as on-time arrival, seats/aircraft and fleet concentration. Given, however, the structural change in the industry, including the emergence of new operational variables driving financial performance, this created systematic forecast errors for the time period after September 11, 2001.

Since changes in operations based variables are generally uncorrelated with one another, it is possible to quantify their impact on the forecast error. Table 1.4 shows the impact of changes in operations based variables on the forecast error. Recall that prior to September 11, 2001 no operations based variables predict forecast error. In contrast, three operations based variables are significant in the post-9/11 subsample (ΔAirtime, ΔFleet Concentration and ΔFlight Length). Analyst forecasts are systematically overstated (negative coefficient) following an increase in airtime, while systematically understated

Table 1.4

Incremental Explanatory Power Predicting Forecast Errors – Reported with Coefficients – Changes Model

$$FE_t = \psi_0 + \psi_1 \Delta OpInc_{t-1} + \psi_2 \Delta NonopInc_{t-1} + \sum_1^M \xi_m * \Delta OV_{m,t-1} + \omega_t \qquad (1.10)$$

DV = Forecast Error/ASM	**Full Sample (*N*=390)**		**Pre-9/11 Sample (*N*=211)**		**Post-9/11 Sample (*N*=132)**	
	Coeff-icient	Average Error Magnitude (¢/ASM)	Coeff-icient	Average Error Magnitude (¢/ASM)	Coeff-icient	Average Error Magnitude (¢/ASM)
Average Forecast Error/ASM		-0.03¢		-0.05¢		0.03¢
Intercept	-0.002**		-0.001		0.000	
Earnings Components						
Δ(Operating Income/ASM)	-0.010		0.067		-0.140**	-0.03¢
Δ(Nonoperating Income/ASM)	-0.016		0.001		-0.058	
Usage Efficiency:						
Δ(RPM/ASM)	0.005		0.010		0.011	
Δ(Airtime)	-0.000		-0.000		-0.001***	-0.03¢
Service Quality:						
Δ(On-Time Arrival)	0.007*	0.00¢	0.002		0.002	
Focus:						
Δ(Fleet Concentration)	0.001		-0.001		0.083***	0.03¢
Δ(Airport Concentration)	-0.090		-0.043		-0.204	
Fleet/Flight Structure:						
Δ(Flight Length)	-0.000		-0.000		0.000***	0.01¢
Δ(# of Seats/Aircraft)	0.000		0.000		0.000	
Adjusted R-squared	***0.362***		***0.578***		***0.491***	

All variables are defined as in Table 1.1.
Each pair of columns provides 1) regression results and 2) average forecast error magnitudes in total (1st row) and forecast error magnitudes associated with operations-based variables that predict forecast error. All coefficients are unstandardized.
***, **, * significant at the p<0.001, 0.01 & 0.05 levels (2-sided).

(positive coefficient) following increases in fleet concentration and flight length. An additional $1/10^{th}$ of an hour of airtime/day (out of an average 8.1 hrs/day) results in an increase of between 2-3¢/share in forecast error.

Similarly, $1/10^{th}$ of a percentage point change in fleet concentration (out of an average concentration of 20.1%) and 10 miles change in average flight length (out of an average flight length of 666 miles) also result in 2-3¢/share additional forecast error. As reference, the average median consensus forecast error/year for the post-9/11 subsample ranges from -10¢/share to 21¢/share.

Discussion and Conclusions

This study uses the airline industry to study the predictive value and analyst use of operations based variables in forecasting future earnings. We show that operations based variables significantly increase the predictive power of accounting-based earnings prediction models. Moreover, the categories of operations based variables that explain future earnings change following the terroristic attacks of September 11, 2001. The aircraft load factor is the important measure of efficiency prior to September 11, 2001 while the airtime becomes significant after September 11, 2001. Similarly, on-time arrival is an important measure of service quality providing explanatory power for predicting future earnings prior to September 11, 2001, yet loses this power afterwards.

We also show that the predictive information found in operations based variables is not fully impounded in analyst forecasts. Forecast errors can be explained using operations based variables. Moreover, we show that this is especially the case after September 11, which suggests that analysts failed to adjust their prediction models to the

new realities of the airline industry.

Our research design, emphasizing industry-specific operations based variables, required us to focus on one single industry. Analyzing the relationship between operations based variables, financial performance, and earnings prediction requires replicating our research design to other industries. Moreover, it would be interesting to study if and to what extent there exist events that can shift the relationship between operations based variables and earnings in an equally substantial manner as happened on September 11, 2001 in the airline industry. At the time of this writing, the financial services sector is in a deep crisis and many of the United States leading financial institutions lost more than half of their market value in a matter of days. It seems unlikely that this would not fundamentally alter the nature of the industry and the set of operations based variables that best predict future success.

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CHAPTER 2

DETERMINANTS OF STICKY COSTS: AN ANALYSIS OF COST BEHAVIOR USING UNITED STATES AIR TRANSPORTATION INDUSTRY DATA

Introduction

Recent cost accounting research identifies costs that respond asymmetrically to increases and decreases in total revenue, a phenomenon described as sticky cost behavior (Banker, Byzalov, & Plehn-Dujowich, 2010a). Researchers have examined sticky costs in an effort to glean information about management capacity decisions in the face of changing demand. Cost will decrease at a slower rate than it increases relative to revenue changes in any of three situations: 1) management retains unused capacity as demand falls in anticipation of future demand resurgence, 2) management adjusts capacity to match sales volume but incurs greater cost when adding capacity than they save by reducing capacity, and 3) management lowers output selling price to increase sales volume as demand decreases to a larger extent than they raise selling price as demand grows. The vast majority of the extant literature focuses on the first explanation (see Banker et al., 2010a for a survey of the literature). In this paper, I provide industry-specific evidence that sticky costs are associated with capacity change and output selling

price change and not associated with management retaining unused capacity. In combination, this evidence suggests that there are multiple determinants of sticky cost behavior and illustrates the importance of precision in modeling if we wish to glean information about management decisions from sticky costs.

Much of the extant literature suggests that sticky cost behavior arises when management does *not* adjust capacity to match fluctuating demand (e.g., Anderson, Banker, & Janakiraman, 2003). This explanation assumes that management does not adjust capacity because: 1) capacity change is costly and 2) there is some probability that the demand fluctuation is temporary. For example, consider capacity decisions in the air transportation industry. Assume there are adjustment costs associated with adding and removing aircraft from the fleet (e.g., seller/buyer search costs, customization/scrap costs, purchase agreement deposits/termination penalties). Facing a drop in demand, airline management must decide whether to retain or remove excess capacity. Sticky costs arise when management retains underutilized aircraft because they determine that the cost of carrying excess capacity (depreciation, rental expense, etc.) is less than the costs of aircraft disposal and future aircraft acquisition if demand resurges. Throughout this paper, I refer to this explanation as "incomplete matching" of capacity and sales volume.

Sticky costs also result when the marginal cost of adding capacity exceeds the marginal benefit from removing capacity as management matches capacity with sales volume (Anderson & Lanen, 2009). To illustrate, consider capacity adjustment in the air transportation industry. Total cost would increase at an increasing rate as management adds aircraft to accommodate demand growth when the marginal cost of each additional

aircraft is increasing. Conversely, total cost would decrease at a decreasing rate as management removes aircraft in response to falling demand when the marginal benefit from selling aircraft is decreasing. In this case, sticky costs result as total cost increases at a faster rate than it decreases as management adjusts capacity to match changing sales volume.

Finally, management may also respond to fluctuating demand by adjusting output selling price to match sales volume with capacity. In fact, economic theory suggests that profit-maximizing management will adjust output selling price to match the changing marginal cost of adding (benefit from reducing) capacity. Consider output selling price adjustment in the air transportation industry. Management would choose to raise output selling price instead of adding capacity when the cost of each additional aircraft increases with growing demand. Similarly, management would choose to lower output selling price instead of removing capacity when the benefit from selling aircraft decreases with falling demand. Sticky costs result when management drops output selling price faster as demand falls than they increase selling price as demand grows. Management will drop selling price faster than they increase it when it is more costly to remove capacity than to add capacity, a condition considered necessary by the extant literature for sticky costs to arise from incomplete capacity adjustment (Banker et al., 2010a).

I make three contributions to the sticky cost literature. First, using a precise model specification, I rule out the incomplete matching explanation for sticky costs in the United States (US) Air Transportation industry. Second, I find evidence that sticky costs are associated with marginal cost of adding capacity that exceeds the marginal benefit

from removing capacity as management makes capacity adjustments. Finally, I demonstrate that output selling price change contributes to sticky costs by identifying an asymmetric association between cost changes and selling price change.

The remainder of Chapter 2 is organized as follows: Section 2.2 develops hypotheses and the research design. Section 2.3 describes the US Air Transportation industry sample. Section 2.4 discusses empirical results. Section 2.5 provides robustness tests and Section 2.6 concludes.

Literature Review and Hypothesis Development

Sticky cost behavior describes an asymmetric cost response to increases and decreases in revenue. The predominant explanation for sticky costs is that management leaves capacity unchanged as demand falls.[5] I argue that we can also observe sticky costs when management adjusts capacity and/or output selling price. Specifically, I suggest that costs increase faster than they decrease when the marginal cost of adding capacity exceeds the marginal benefit from removing capacity as management makes capacity adjustments. I further argue that sticky costs can arise when management adjusts sales volume by changing output selling price. Sticky costs can arise when management lowers output selling price to a greater degree when demand falls than they raise it when demand grows. Management will adjust prices accordingly when the marginal benefit from removing capacity decreases faster than the marginal cost of adding capacity increases.

[5] Working papers by Anderson and Lanen (2009) and Balakrishnan, Labro, and Plehn-Dujowich (2010) are exceptions. Anderson and Lanen suggest and offer evidence that sticky cost behavior is neither prevalent nor consistent with the incomplete matching explanation (Anderson et al., 2003). Balakrishnan et al. model and use simulated data to provide evidence that sticky costs can arise from committed fixed cost. This paper uses the Balakrishnan et al. model that removes the influence of committed fixed cost.

The following subsections develop the hypotheses that sticky costs are associated with incomplete matching of capacity and sales volume, and that sticky costs are associated with changing capacity and output selling price. Further, they provide model specifications that test these hypotheses.

Incomplete Matching of Capacity and Sales Volume as a Determinant of Sticky Cost Behavior

Noreen and Soderstrom (1997) first identify asymmetric cost responses while using hospital data to assess the accuracy of proportional cost models. In 2003, Anderson et al. coin the phrase "sticky costs" to describe costs that increase faster than they decrease with revenue change. Balakrishnan, Labro, and Soderstrom (2010) propose the following model to identify sticky cost behavior:[6,7]

$$\frac{C_{i,t} - C_{i,t-1}}{q_{i,t-1}} = \beta_0 + \beta_1\left(\frac{R_{i,t} - R_{i,t-1}}{R_{i,t-1}}\right) + \beta_2 DEC_{i,t} * \left(\frac{R_{i,t} - R_{i,t-1}}{R_{i,t-1}}\right) + \varepsilon_{i,t} \qquad (2.1)$$

Variables:

$C_{i,t}$ = Total cost for firm i at time t

[6] Anderson et al. (2003) propose a model based on logarithmic total cost and total revenue changes. Using simulated data, Balarishnan et al. (2010) demonstrate that the Anderson et al. model captures 'mechanical' sticky cost behavior associated with committed fixed cost. Balakrishnan et al. propose an alternative specification that eliminates committed fixed cost from the dependent variable by removing committed fixed cost from the denominator of the dependent variable. I remove committed fixed cost effects by deflating cost change by lagged output quantity.

[7] Note that the Balakrishnan et al. (2010) regression omits the main effect of the decreasing revenue indicator variable ($DEC_{i,t}$). Implicit in its omission is that any difference between cost changes in times of increasing and decreasing revenue is only associated with costs that vary with changes in revenue. I relax this assumption as a robustness test in Section 2.5.

$q_{i,t}$ = Output quantity for firm *i* at time *t*

$R_{i,t}$ = Sales revenue for firm *i* at time *t*

$DEC_{i,t}$ = An indicator variable set to 1 if revenue decreased for firm *i* in time *t*, and set to 0 otherwise

β_0 = Parameter that estimates systematic cost change unassociated with revenue change

β_1 = Parameter that estimates the association between cost change and a revenue increase

β_2 = "Sticky cost" parameter that estimates the difference between cost change associated with a sales revenue decrease and change associated with a sales revenue increase

$\varepsilon_{i,t}$ = Cost change estimation error term for firm *i* at time *t*

The intercept (β_0) captures systematic cost change that is not associated with sales revenue change. Parameter estimates (β_1) and $(\beta_1 + \beta_2)$ measure the rate of cost change relative to revenue change during periods of increasing and decreasing revenue. Cost exhibits sticky behavior if it increases at a faster rate than it decreases with revenue changes. A negative β_2 coefficient indicates sticky costs.

Anderson et al. (2003) attribute sticky costs to management's incomplete matching of capacity and sales volume. They suggest that management, when faced with falling demand, will *not* remove capacity because 1) it is costly to adjust capacity and 2) there is some probability that demand will recover. Banker et al. (2010a) explain that profit-maximizing management face a trade-off between the cost of leaving capacity unchanged (cost of unused capacity or foregone sales) against the cost of adjusting

capacity today and the expected cost of reversing the capacity change in the future. They posit that we generally observe sticky costs because the adjustment cost of disposing of capacity typically exceeds that of adding capacity (Cooper & Haltiwanger, 2006) and demand is generally growing. Most of the remaining research focuses on explaining variation in sticky cost behavior by adding proxies for adjustment cost (Balakrishnan & Gruca, 2008; Chen, Lu, & Sougiannis, 2011; Dierynck & Renders, 2009; Kama & Weiss, 2010) and economic outlook (Banker, Ciftci, & Mashruwala, 2010b; Kama & Weiss, 2010) to equation 2.1.[8,9]

H2.1: Change in capacity relative to change in sales volume as revenue increases is greater than change in capacity relative to change in sales volume as revenue decreases.

Equation 2.1 provides an imprecise test of the incomplete matching of capacity and sales volume explanation for sticky costs. Specifically, it uses total cost to proxy for capacity and total revenue to proxy for sales volume. Replacing total cost $(C_{i,t})$ with output quantity $(q_{i,t})$ and total revenue $(R_{i,t})$ with sales volume $(v_{i,t})$ provides a more precise test of whether management retains unused capacity as sales volume falls. However, the model no longer accounts for the marginal cost of adding capacity and

[8] A few papers use incomplete adjustment of capacity and sales volume to explain predictive associations between cost change and future profit (Anderson, Banker, Huang, & Janakiraman, 2007; Banker & Chen 2006; Baumgarten, Bonenkamp, & Homburg, 2010).

[9] The literature that associates proxies for adjustment cost and economic outlook with sticky cost behavior also uses derivations of the Anderson et al. (2003) logarithmic model using total cost and total revenue changes.

marginal benefit from removing capacity. This is problematic because economic theory suggests that management's capacity decision (the dependent variable) is influenced by the marginal cost of/benefit from adjusting capacity. Similarly, sales volume change (the independent variable) is determined by management's output selling price decision, which is also influenced by the marginal cost of/benefit from adjusting capacity. Therefore, the regression is unspecified if it omits a proxy for the marginal cost of/benefit from adjusting capacity, resulting in biased parameter estimates.[10]

One solution would be to include capacity unit cost change as an independent variable to proxy for the marginal cost of/benefit from adjusting capacity. However, capacity unit cost change is determined by capacity change (the dependent variable). Therefore, including capacity unit cost change as an independent variable induces a simultaneity bias, also resulting in biased parameter estimates.[11] To mitigate this problem, I use a two-stage least-squares approach to produce an exogenous instrumental variable for capacity unit cost change, thereby avoiding biased parameter estimates. Specifically, the first-stage regression estimates capacity unit cost change using industry-level capacity unit cost change and three proxies for firm-level production function change (see Appendix A for the instrumental variable regression specification and results). Industry-level capacity unit cost change proxies for changes in the market value of capacity and industry-standard adjustment costs outside management's control.

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[10] Specifically, an unspecified regression that excludes a construct correlated with both the independent and dependent variables suffers from omitted-variable bias. This bias results when the statistical model compensates for the omitted variable by over- or understating the statistical significance of another independent variable (Greene, 1993).

[11] Simultaneity bias results in over- or understated parameter estimates as the model compensates for covariance between the endogenous independent variable and the regression error term (Greene, 1993).

Essentially, this assumes that management is presented with an exogenous set of costs/benefits from adjusting capacity offered by the industry.[12] The production function proxies capture firm-level production function changes that influence capacity unit cost (Banker & Johnston, 1993), but do not and are not influenced by management's capacity adjustment decision. Equation 2.2 presents the second-stage regression used to test hypothesis 2.1:

$$\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}} = \theta_0 + \theta_1\left(\frac{v_{i,t}-v_{i,t-1}}{v_{i,t-1}}\right) + \theta_2 DEC_{i,t} * \left(\frac{v_{i,t}-v_{i,t-1}}{v_{i,t-1}}\right) + \theta_3\left(iv\left\{\frac{c_{i,t}-c_{i,t-1}}{c_{i,t-1}}\right\}\right) + \omega_{i,t} \quad (2.2)$$

Variables:

$v_{i,t}$ = Sales volume for firm *i* at time *t*

$c_{i,t}$ = Average capacity unit cost $\left(C_{i,t}/q_{i,t}\right)$ for firm *i* at time *t*

$iv\{\}$ = Instrumental variable operator

θ_0 = Parameter that estimates systematic output quantity change unassociated sales volume change

θ_1 = Parameter that estimates the association between output quantity change and sales volume change during periods when revenue is increasing

θ_2 = "Sticky cost" parameter that estimates the difference in the association between output quantity change and sales volume change when revenue is increasing and decreasing

[12] The specification assumes that any particular firm's capacity decision does not influence industry-level capacity unit costs. It is possible that management across all firms in the US Air Transportation industry behave identically with respect to capacity change. In this case, industry-level capacity unit cost change is simultaneously determined by firm-level capacity change (as a proxy for industry-level capacity change). It does not appear that this is the case because the pairwise correlation between industry- and firm-level capacity unit cost change is only 0.284.

θ_3 = Parameter that estimates association between output quantity change and an exogenous proxy for change in average capacity unit cost

$\omega_{i,t}$ = Output quantity change estimation error term for firm *i* at time *t*

Parameter estimates θ_1 and $\theta_1 + \theta_2$ measure output quantity change associated with sales volume change as revenue increases and decreases, respectively. A negative θ_2 coefficient indicates that management reduces output quantity at a slower rate than they increase it with sales volume changes. This provides the empirical test of hypothesis 2.1 and is consistent with the incomplete matching explanation for sticky costs offered by the extant literature. A mathematical derivation of parameter estimates θ_1 and $\theta_1 + \theta_2$ is included in Appendix B.

Capacity and Output Selling Price Changes as Determinants of Sticky Cost Behavior

Sticky costs also arise when total cost increases faster as management adds capacity than it decreases as management removes capacity. This phenomenon is consistent with increasing marginal cost of adding capacity (a condition that Balakrishnan et al., 2010 term "diseconomies of scale") and decreasing marginal benefit from removing capacity. For example, consider a capacity resource such as an aircraft whose aggregate supply is limited and which has few uses beyond air transportation. As demand for air transportation grows, the marginal cost of an additional aircraft increases due to limited supply. Conversely, as demand falls, the marginal benefit from selling the aircraft decreases because there are limited alternative uses to generate demand for the

excess aircraft capacity.

In this case, sticky costs arise not because management retains unused resources but because the marginal cost of adding capacity exceeds the marginal benefit from removing capacity. Anderson and Lanen (2009) point out that adjustment costs increase the marginal cost of adding capacity and/or decrease the marginal benefit from removing capacity. As such, consistent with empirical results found in the literature (e.g., Anderson et al., 2003; Balakrishnan & Gruca, 2008), adjustment costs are expected to be positively associated with sticky costs that arise when management makes *changes* to its capacity in addition to when management retains unused capacity to avoid incurring adjustment cost.

H2.2: Change in cost relative to change in capacity as revenue increases is greater than change in cost relative to change in capacity as revenue decreases.

Recall that sticky costs are generally defined by total costs that increase faster than they decrease with *changes in total revenue* (equation 2.1).[13] Total revenue is the product of sales volume and output selling price and therefore influenced by price change. As a result, sticky costs may manifest themselves when management adjusts output selling price to change sales volume as opposed to adjusting capacity. Specifically, sticky costs result when management lowers output selling price to a greater degree as demand falls than they raise price as demand grows. Economic theory suggests that

[13] Balakrishnan and Gruca (2008) find evidence of sticky costs when replacing revenue with patient-days as an activity measure.

profit-maximizing management will reduce output selling price to match decreasing marginal benefit from removing capacity as demand falls. Similarly, management will increase output selling price to match increasing marginal cost of adding capacity. It follows that sticky costs arise when the marginal benefit from removing capacity decreases faster than the marginal cost of adding capacity increases. This phenomenon is consistent with disposition cost that exceeds acquisition cost, a condition considered necessary for sticky costs to result from incomplete matching of capacity and sales volume (Banker et al., 2010a).[14]

H2.3: Change in cost relative to change in output selling price as revenue increases is greater than change in cost relative to change in output selling price as revenue decreases.

Hypothesis 2.2 suggests that costs change asymmetrically because the marginal cost of adding capacity exceeds the marginal benefit from removing capacity as management makes capacity adjustments. To test hypothesis 2.2, I must empirically isolate cost change associated with capacity adjustment. I do this by using output quantity instead of total revenue as an activity measure.[15] Using output quantity isolates cost variation associated with changing marginal cost of adding capacity and marginal benefit

[14] It is also possible the marginal benefit from removing capacity is lower than the marginal cost of increasing capacity because management recognizes disposition costs at the time the asset is sold while amortizing acquisition costs over an asset's projected life.

[15] Output quantity change is an imperfect proxy for capacity change if management changes the proportion of its capacity used to produce output. For example, in the Air Transportation industry, management may reduce the time in which aircraft are airborne, effectively reducing output without removing capacity. In Section 2.5, I provide a robustness test to account for this possibility.

from removing capacity (see Appendix B). Hypothesis 2.3 suggests that costs change asymmetrically with respect to revenue because management adjusts sales volume to match capacity by changing output selling price. Specifically, sticky costs arise when management reduces output selling price rather than cost to a larger degree as demand falls than they increase selling price instead of cost as demand grows. To test hypothesis 2.3, I estimate the association between cost change and output selling price:

$$\frac{C_{i,t}-C_{i,t-1}}{q_{i,t-1}}=\phi_0+\phi_1\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)+\phi_2 DEC_{i,t}*\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)+\phi_3\left(\frac{p_{i,t}-p_{i,t-1}}{p_{i,t-1}}\right)$$
$$+\phi_4 DEC_{i,t}*\left(\frac{p_{i,t}-p_{i,t-1}}{p_{i,t-1}}\right)+\tau_{i,t} \quad (2.3)$$

Variables:

$p_{i,t}$ = Average output selling price $\left(R_{i,t}/v_{i,t}\right)$ for firm *i* at time *t*

ϕ_0 = Parameter that estimates systematic cost change unassociated with output quantity and output selling price changes

ϕ_1 = Parameter that estimates the association between cost change and output quantity change during periods when revenue is increasing

ϕ_2 = "Sticky cost" parameter that estimates the difference in the association between cost change and output quantity change when revenue is increasing and decreasing

ϕ_3 = Parameter that estimates the association between cost change and output selling price change during periods when revenue is increasing

ϕ_4 = "Sticky cost" parameter that estimates the difference in the association between cost change and output selling price change when revenue is increasing and decreasing

$\tau_{i,t}$ = Cost change estimation error term for firm *i* at time *t*

Parameter estimates ϕ_1 and $\phi_1 + \phi_2$ measure the marginal cost of adding output quantity as revenue increases and the marginal benefit from reducing output quantity as revenue decreases, respectively. A negative ϕ_2 coefficient indicates that the marginal cost of adding output is greater than the marginal benefit from removing output. This provides an empirical test of hypothesis 2.2 and is consistent with the increasing marginal cost of/decreasing marginal benefit from capacity adjustment explanation for sticky costs. By using output quantity instead of total revenue or sales volume to measure cost-generating activity, the parameter estimates are not influenced by incomplete matching of output quantity and sales volume.

Parameter estimates ϕ_3 and $\phi_3 + \phi_4$ measure the extent to which management adjusts output selling price relative to cost as revenue increases and decreases. A negative ϕ_4 coefficient indicates that management reduces selling price in lieu of cost reduction as demand decreases to a larger extent than they increase selling price in lieu of cost increases as demand grows. This provides an empirical test of hypothesis 2.3 and is consistent with the changing output selling price explanation for sticky costs. For further illustration, Appendix B provides a mathematical derivation of the parameter estimates.

Sample Description

The sample data structure can be characterized as a time-series cross-sectional dataset using firm-quarter observations. I control for cross-sectional correlation (temporal

effects associated with all firms) by including year indicator variables and for firm fixed effects (systematic differences between firms over time) by including firm indicator variables (Petersen, 2009). I control for quarterly seasonality by calculating all changes using same quarters in subsequent years. Finally, the parameter estimates are calculated using generalized least squares regression with the Prais-Winsten estimator (Prais & Winsten, 1954) to correct for panel-specific auto-regression (Vogelsang, 1998).

The sample includes observations taken from nine airlines across 16 years (from 1992 through 2007).[16] Continental Airlines and Northwest Airlines provide financial data beginning in 1994 and 1995, respectively. US Airways and America West Airlines merge, effective the third quarter of 2005. These missing data leave an initial sample size of 540 firm-quarters. The initial sample includes 31 observations that suffer from changes in accounting policy (e.g., reclassification of other expense to rental expense) or anomalous reporting (e.g., mismatched changes in affiliate revenue and cost). These observations are identified by inspecting observations with absolute studentized residuals greater than 3 and Cook's D residuals greater than 2. The final sample consists of 509 usable observations. The sample selection process is described in Table 2.1.

This study is, in part, a response to a recent call for industry-specific insights into sticky cost behavior (e.g., Balakrishnan et al., 2010). Industry-specific analysis increases the probability that sampled firms have similar cost structures and experience similar growth opportunities. Data from the US Air Transportation industry (airline industry) are particularly well-suited to identify determinants of sticky cost behavior for several

[16] The airlines include Delta Airlines, United Airlines, America West Airlines, Southwest Airlines, US Airways, Continental Airlines, Northwest Airlines, and Alaska Airlines.

Table 2.1

Sample Selection

Reduction	Total Firm-quarters
Industry (1992 – 2007)	576
Missing Data (Northwest Airlines begins 1995, Continental begins 1994)	(24)
US Airways/America West Airlines Merger (mid-1995)	(12)
Subtotal Industry	540
Outliers due to accounting changes and anomalies[1]	(31)
Total Sample	**509**

[1] Influential firm-quarter observations are identified using studentized residuals greater than 3 or less than –3 and Cook's D residuals greater than 2. Each influential observation is examined to determine if it is associated with changes in accounting policy (i.e., Delta changed its accounting for regional carrier expense without a corresponding change in regional carrier revenue during 2006) or anomalous reporting (i.e., Due to the America West Airlines merger, US Airways did not report a full period of revenue during the first half of 2005). All observations influenced by changes in accounting policy and/or anomalous reporting are removed from the sample.

reasons. First, a large proportion of the extant literature posits that sticky cost behavior arises from incomplete matching of capacity and sales volume (see Banker et al., 2010a for a summary of the literature). The airline industry provides identifiable units of capacity (available seat-miles, ASM) and sales volume (revenue passenger-miles, RPM), allowing the empirical comparison of changes in capacity and sales volume.

Second, airlines segregate their costs such that it is simple to form a measure of capacity expense (Banker & Johnston, 1993). Specifically, airlines report depreciation, aircraft rental payments, maintenance expense, and payments to regional affiliates. Further, these costs are generated by capital-intensive assets. Prior literature has positively associated capital-intensity (as a proxy for adjustment costs) with sticky costs (Anderson et al., 2003). Third, air transportation is relatively homogeneous, alleviating concerns about the influence of changing product mix on capacity unit cost and output

selling price (Anderson & Lanen, 2009).

Finally, the sample is comprised of firms that have experienced substantial variation in performance. Some airlines, such as Southwest, performed well while most (American, Delta, United, America West, US Airways, Continental and Northwest) have struggled. Each airline has experienced fluctuations in revenue, providing periods in which management must decide whether to retain/change capacity and/or sales volume.

All of the data were computed using quarterly Securities and Exchange Commission (SEC) filings. Panel A of Table 2.2 provides descriptive statistics and data definitions. Panel B of Table 2.2 reports the number of firm-quarters in which revenue increases and decreases along with mean changes in capacity expense, total revenue, sales volume, output selling price, output quantity, and capacity unit cost for each subsample. Note that revenue is growing for the majority of sampled periods (410 out of 509). This trend is consistent with larger samples used in the extant literature (e.g., Anderson et al., 2007; Banker et al., 2010a). As would be expected, capacity expense increases during revenue-increasing periods. However, capacity expense change does not differ from zero during revenue-decreasing periods. This is consistent with sticky costs (costs that decrease more slowly than they increase with fluctuating demand). The absolute magnitude of total revenue change is comparable between revenue-increasing and revenue-decreasing periods. In contrast, sales volume increases more than twice as much as it decreases. Conversely, average selling price decreases almost four times as much as it increases. This is consistent with output selling prices that decrease faster than they increase, preserving sales volume through lower prices as demand falls. Output

Table 2.2

Descriptive Statistics and Data Definitions

Panel A – Variable Descriptions and Statistics

Variable (N=509)	Variable Calculation	Description	Mean	Median	Std.	1st Quartile	3rd Quartile
Variable Definitions							
Capacity Expense	$C_{i,t}$	Payments to regional affiliates, maintenance expense, depreciation expense, and rental expense	$422 million	$410 million	$302 million	$162 million	$641 million
Output Quantity	$q_{i,t}$	Total aircraft seat-miles available for purchase (ASM)	23,337 million	22,693 million	13,951 million	9,649 million	37,224 million
Revenue	$R_{i,t}$	Total net revenue	$2,439 million	$2,340 million	$1,528 million	$887 million	$3,667 million
Sales Volume	$v_{i,t}$	Total aircraft seat-miles sold to passengers (RPM)	16,806 million	16,770 million	10,402 million	6,516 million	25,916 million
Output Selling Price	$p_{i,t}$	Total net revenue divided by total aircraft seat-miles sold to passengers ($R_{i,t}/v_{i,t}$)	14.5¢	14.3¢	2.2¢	13.1¢	15.6¢
Capacity Unit Cost	$c_{i,t}$	Total Capacity Expense divided by ASM ($C_{i,t}/q_{i,t}$)	1.9¢	1.8¢	0.7¢	1.5¢	2.2¢
Dependent Variable							
Capacity Expense Change	$\left(\frac{C_{i,t}-C_{i,t-4}}{q_{i,t-4}}\right)$	Seasonally-adjusted change in Capacity Expense divided by lagged Output Quantity	0.13¢***	0.09¢***	0.31¢	–0.01¢	0.21¢
Independent Variables							
Percent Sales Revenue Change	$\left(\frac{R_{i,t}-R_{i,t-4}}{R_{i,t-4}}\right)$	Seasonally-adjusted change in Revenue divided by lagged Revenue	6.0%***	6.6%***	11.1 pts	1.6%	11.3%
Percent Sales Volume Change	$\left(\frac{v_{i,t}-v_{i,t-4}}{v_{i,t-4}}\right)$	Seasonally-adjusted change in RPM divided by lagged RPM	5.9%***	5.4%***	9.3 pts	1.0%	11.2%
Percent Average Selling Price Change	$\left(\frac{p_{i,t}-p_{i,t-4}}{p_{i,t-4}}\right)$	Seasonally-adjusted change in Output Selling Price divided by lagged Output Selling Price	0.2%	0.3%	6.8 pts	–3.1%	4.4%
Percent Output Quantity Change	$\left(\frac{q_{i,t}-q_{i,t-4}}{q_{i,t-4}}\right)$	Seasonally-adjusted change in Output Quantity divided by lagged Output Quantity	4.1%***	3.9%***	8.2 pts	–0.0%	8.4%

Table 2.2 (continued)

Panel B – Mean Values in Revenue-increasing and Revenue-decreasing subsamples			
Variable	Variable Calculation	*Revenue-increasing Periods (DEC=0)*	*Revenue-decreasing Periods (DEC=1)*
Firm-Quarters		410	99
Capacity Expense Change (scaled by lagged output quantity)	$\left(\frac{C_{i,t}-C_{i,t-4}}{q_{i,t-4}}\right)$	0.17¢***	–0.01¢
Percent Sales Revenue Change	$\left(\frac{R_{i,t}-R_{i,t-4}}{R_{i,t-4}}\right)$	9.7%***	–9.1%***
Percent Sales Volume Change	$\left(\frac{v_{i,t}-v_{i,t-4}}{v_{i,t-4}}\right)$	8.2%***	–3.3%***
Percent Average Selling Price Change	$\left(\frac{p_{i,t}-p_{i,t-4}}{p_{i,t-4}}\right)$	1.6%***	–5.9%***
Percent Output Quantity Change	$\left(\frac{q_{i,t}-q_{i,t-4}}{q_{i,t-4}}\right)$	5.8%***	–2.7%***
Percent Change in Average Capacity Unit Cost	$\left(\frac{c_{i,t}-c_{i,t-4}}{c_{i,t-4}}\right)$	3.4%***	2.3%*

$C_{i,t}$ = Total Cost for firm *i* at time *t*

$q_{i,t}$ = Output quantity for firm *i* at time *t*

$R_{i,t}$ = Sales revenue for firm *i* at time *t*

$v_{i,t}$ = Sales Volume for firm *i* at time *t*

$p_{i,t}$ = Average Output Selling Price for firm *i* at time *t*

$c_{i,t}$ = Average Capacity Unit Cost for firm *i* at time *t*

*, **, and *** indicate significance at the $p<0.05$, 0.01, and 0.001 levels respectively (2-tailed test).

- Throughout the sample time period, major airlines add and divest subsidiary airlines and engage in capacity purchase agreements. Subsidiary and capacity purchase agreement operations data, when available, was added to major airlines for all quarters in which subsidiary and capacity purchase agreement accounting performance was reflected in consolidated numbers to enhance comparability.

- Revenue and cost data were hand-collected from SEC filings and were reconciled to match IBES reported actual net income. Nonrecurring expense items are typically excluded. Operations-based data are collected from SEC filings, monthly Air Travel Consumer Report (ATCR) issued by the United States Department of Transportation, and the Transtats database offered by the Bureau of Transportation Services.

quantity (ASM) increases over twice as much as it decreases, suggesting that managers are more willing to add capacity than remove capacity with fluctuating demand. Finally, change in capacity unit cost is positive for both subsamples. This supports the conclusion that the marginal cost of adding capacity is increasing while the marginal benefit from removing capacity is decreasing during periods of revenue growth and decline, respectively.

Primary Results

Table 2.3 Panels A and B present regression results from applying airline industry data to equations 2.1 and 2.2, respectively. Table 2.3 Panel A reports results using equation 2.1 to perform sticky cost analyses consistent with those found in the extant literature (e.g., Anderson et al., 2003). Note that the adjusted *R*-squared is 0.328 comparable with the adjusted *R*-squared (0.366) found in Anderson et al. (2003, Table 2 Model I). The overall model is significant at the $p<0.001$ level. The sign of each equation 2.1 parameter estimate is consistent with those found by Anderson et al. The negative value ($p<0.001$) on the sticky cost parameter (β_2) indicates that capacity expense decreases at a slower rate than it increases with changes in revenue (i.e., airline capacity cost is sticky). The magnitude of the parameter estimates can be interpreted as cost change (in pennies per lagged ASM) associated with 1% change in revenue.

Table 2.3 Panel B reports results using equation 2.2 to test hypothesis 2.1. Note that the adjusted *R*-squared is 0.785, indicating a much better fit than the model using total cost and revenue. The model is significant at a $p<0.001$ level. Output quantity

Table 2.3

Determinants of Sticky Cost Behavior – Regression Results Using Cost and Revenue Changes Compared with Output Quantity and Sales Volume Changes

Panel A: Cost Change regressed on Revenue Change

$$\frac{C_{i,t}-C_{i,t-1}}{q_{i,t-1}}=\beta_0+\beta_1\left(\frac{R_{i,t}-R_{i,t-1}}{R_{i,t-1}}\right)+\beta_2 DEC_{i,t}*\left(\frac{R_{i,t}-R_{i,t-1}}{R_{i,t-1}}\right)+\varepsilon_{i,t} \quad (2.1)$$

Variable	Parameter	Expected Sign	Parameter (*t*-statistic)
Intercept	(β_0)	(?)	0.000 (1.12)
$\left(\frac{R_{i,t}-R_{i,t-1}}{R_{i,t-1}}\right)$	(β_1)	(+)	0.014 (12.76)***
$DEC_{i,t}*\left(\frac{R_{i,t}-R_{i,t-1}}{R_{i,t-1}}\right)$	(β_2)	(–)	–0.009 (–4.05)***
Adjusted R^2			*0.328*
Firm-quarters (N)			509

Panel B: Output Quantity Change regressed on Sales Volume Change

$$\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}=\theta_0+\theta_1\left(\frac{v_{i,t}-v_{i,t-1}}{v_{i,t-1}}\right)+\theta_2 DEC_{i,t}*\left(\frac{v_{i,t}-v_{i,t-1}}{v_{i,t-1}}\right)+\theta_3\left(iv\left\{\frac{c_{i,t}-c_{i,t-1}}{c_{i,t-1}}\right\}\right)+\omega_{i,t} \quad (2.2)$$

Variable	Parameter	Expected Sign	Parameter (*t*-statistic)
Intercept	(θ_0)	(?)	0.008 (0.80)
$\left(\frac{v_{i,t}-v_{i,t-1}}{v_{i,t-1}}\right)$	(θ_1)	(+)	0.737 (13.69)***
$DEC_{i,t}*\left(\frac{v_{i,t}-v_{i,t-1}}{v_{i,t-1}}\right)$	(θ_2)	(–)	0.066 (1.00)
$iv\left\{\frac{c_{i,t}-c_{i,t-1}}{c_{i,t-1}}\right\}$	(θ_3)	(–)	–0.193 (–2.73)**
Adjusted R^2			*0.785*
Firm-quarters (N)			509

*, **, and *** indicate significance at the $p<0.05$, 0.01, and 0.001 levels, respectively (1-tailed test).
All variables are calculated as defined in Table 2.2.

change is positively associated with sales volume change during revenue-increasing periods (θ_1>0, p<0.001), consistent with management increasing capacity to accommodate demand growth. The sticky cost parameter (θ_2) does not significantly differ from zero (p<0.32), indicating that management does *not* decrease output quantity relative to sales volume at a slower rate as revenue falls than they increase it as revenue grows. This result does not support hypothesis 2.1. Further, it is inconsistent with sticky cost results found when estimating equation 2.1. Together, results from equations 2.1 and 2.2 suggest that capacity expense is sticky, but *not* because management is hesitant to remove unused output.

Table 2.4 reports results using equation 2.3 to test hypotheses 2.2 and 2.3. Note that the adjusted *R*-squared is 0.329. The model is significant at a p<0.001 level. The negative value (p<0.001) on the output quantity sticky cost parameter (ϕ_2) indicates that capacity expense decreases at a slower rate than it increases with changes in output quantity (i.e., capacity cost is sticky with respect to output quantity). This result supports hypothesis 2.2 and is consistent with increasing marginal cost of adding capacity and decreasing marginal benefit from removing capacity. The magnitude of the parameter estimates ϕ_1 and $\phi_1+\phi_2$ can be interpreted as the marginal cost of adding output quantity and the marginal benefit from removing output (in dollars per ASM) as revenue increases and decreases, respectively (see Appendix B).

The positive association (p<0.001) between cost change and output selling price change (ϕ_3) suggests that management adds capacity (subsequently increasing cost) *and* increases selling price as demand grows. The negative value (p<0.001) on the output

Table 2.4

Determinants of Sticky Cost Behavior – Regression Results Using Output Quantity and Output Selling Price

$$\frac{C_{i,t}-C_{i,t-1}}{q_{i,t-1}}=\phi_0+\phi_1\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)+\phi_2 DEC_{i,t}*\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)+\phi_3\left(\frac{p_{i,t}-p_{i,t-1}}{p_{i,t-1}}\right)+\phi_4 DEC_{i,t}*\left(\frac{p_{i,t}-p_{i,t-1}}{p_{i,t-1}}\right)+\tau_{i,t} \quad (2.3)$$

Variable	Parameter	Expected Sign	Parameter (*t*-statistic)
Intercept	(ϕ_0)	(?)	0.000 (1.09)
$\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)$	(ϕ_1)	(+)	0.019 (11.01)***
$DEC_{i,t}*\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)$	(ϕ_2)	(–)	–0.011 (–4.66)***
$\left(\frac{p_{i,t}-p_{i,t-1}}{p_{i,t-1}}\right)$	(ϕ_3)	(+)	0.012 (8.67)***
$DEC_{i,t}*\left(\frac{p_{i,t}-p_{i,t-1}}{p_{i,t-1}}\right)$	(ϕ_4)	(–)	–0.009 (–3.40)***
Adjusted R^2			*0.329*
Firm-quarters (N)			509

*, **, and *** indicate significance at the $p<0.05$, 0.01, and 0.001 levels, respectively (1-tailed test).
All variables are calculated as defined in Table 2.2.

selling price sticky cost parameter (ϕ_4) indicates that management reduces output selling price rather than cost when demand falls. This supports hypothesis 2.3 and is consistent with marginal benefit from removing capacity that decreases faster than the marginal cost of adding capacity increases.

In summary, capacity cost in the airline industry is sticky with respect to revenue change. However, output quantity is *not* sticky with respect to sales volume. Together, these results suggest that sticky costs can arise from determinants other than incomplete matching of capacity and sales volume. Further evidence suggests that sticky costs are associated with increasing marginal cost of adding output and decreasing marginal benefit from removing output. The evidence also suggests that management lowers output selling price faster than they increase it as demand fluctuates. In combination, the results suggest that sticky capacity cost in the airline industry is associated with changing output quantity and output selling price as management matches output quantity and sales volume.

Robustness Tests

I run three robustness tests to validate the primary results. First, Anderson and Lanen (2009) point out that the models offered in the extant literature omit the main effect of the decreasing revenue indicator variable ($DEC_{i,t}$). This specification implicitly assumes that costs do not change systematically during periods of increasing and decreasing revenue *except* through their association with revenue change (or other activity proxies). I relax this assumption by adding an indicator variable main effect term

($DEC_{i,t}$) to each model (equations 2.1, 2.2, and 2.3). In untabulated results, the main effect does not significantly differ from zero. Further, all other parameter estimates remain consistent with results reported in Tables 2.3 and 2.4.

Second, Balakrishnan et al. (2010) suggest that variation in annual growth rates may influence sticky cost behavior. I include an interaction term between the decreasing revenue indicator variable ($DEC_{i,t}$) and year indicator variables to pick up systematic annual variation in asymmetric cost behavior. In untabulated results for each model (equations 2.1, 2.2, and 2.3), all parameter estimates remain consistent with the primary results reported. Additionally, the statistical fit (adjusted *R*-squared) of each model does not significantly increase by including the interaction terms.

Third, it is possible that airline managers adjust ASM to match sales volume without adjusting the quantity of resources that generate ASM. For example, management may allow aircraft to sit idle for a greater proportion of each day during periods of decreasing revenue. In this situation, using ASM as a proxy for capacity, it may appear that airline managers are *adjusting* capacity to match sales volume when they are actually generating less output per capacity resource. I control for this effect by substituting number of fleet aircraft-seats for ASM. The pair-wise correlations between changes in ASM and aircraft-seats and changes in capacity expense per ASM and capacity expense per aircraft-seat are 0.711 (p<0.001) and 0.989 (p<0.001), respectively.

Untabulated regression results from substituting aircraft-seats for ASM in equations 2.1 and 2.2 are consistent with results reported in Table 2.3, providing no support for hypothesis 2.1. This indicates that sticky capacity cost in the airline industry

is *not* associated with the incomplete matching of capacity and sales volume. Table 2.5 reports regression results from substituting aircraft-seats for ASM in equation 2.3 to test hypotheses 2.2 and 2.3. The adjusted *R*-squared is 0.231, somewhat lower than the explanatory power using ASM (0.329, reported in Table 2.4). The model is significant at a $p<0.001$ level. The negative value ($p<0.05$) on the output quantity sticky cost parameter (ϕ_2) supports hypothesis 2.2, indicating that capacity expense decreases at a slower rate than it increases with changes in output quantity. The sticky cost parameter on output selling price change (ϕ_4) no longer supports hypothesis 2.3 ($p=0.44$). This result suggests that management adjusts output selling price to equivalent degrees as demand fluctuates. This is consistent with marginal cost that increases to the same extent that marginal benefit decreases as management adjusts capacity. To summarize, capacity cost using aircraft-seats is sticky, aircraft-seats are *not* sticky with respect to sales volume, and the marginal cost of adding aircraft-seats exceeds the marginal benefit from removing aircraft-seats. Finally, output selling price is not associated with sticky costs, suggesting the marginal benefit from removing aircraft-seats does not decrease faster than the marginal cost of adding aircraft-seats increases.

In summary, the robustness tests provide support for hypothesis 2.2, but do not consistently support hypotheses 2.1 and 2.3. Cost responds asymmetrically to output quantity change, indicative of marginal cost of adding capacity that exceeds the marginal benefit from removing capacity. However, output quantity does *not* respond asymmetrically to sales volume change and cost does not respond asymmetrically to changing output selling price when using aircraft-seats to proxy for capacity.

Table 2.5

Determinants of Sticky Cost Behavior – Regression Results Using Aircraft-Seats Instead of ASM as a Measure of Capacity

$$\frac{C_{i,t}-C_{i,t-1}}{q_{i,t-1}}=\phi_0+\phi_1\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)+\phi_2 DEC_{i,t}*\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)+\phi_3\left(\frac{p_{i,t}-p_{i,t-1}}{p_{i,t-1}}\right)+\phi_4 DEC_{i,t}*\left(\frac{p_{i,t}-p_{i,t-1}}{p_{i,t-1}}\right)+\tau_{i,t} \quad (2.3)$$

Variable	Parameter	Expected Sign	Parameter (*t*-statistic)
Intercept	(ϕ_0)	(?)	0.000 (1.59)
$\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)$	(ϕ_1)	(+)	0.005 (6.91)***
$DEC_{i,t}*\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)$	(ϕ_2)	(–)	–0.002 (–1.96)*
$\left(\frac{p_{i,t}-p_{i,t-1}}{p_{i,t-1}}\right)$	(ϕ_3)	(+)	0.002 (5.82)***
$DEC_{i,t}*\left(\frac{p_{i,t}-p_{i,t-1}}{p_{i,t-1}}\right)$	(ϕ_4)	(–)	–0.000 (–0.57)
Adjusted R^2			*0.231*
Firm-quarters (N)			482

*, **, and *** indicate significance at the $p<0.05$, 0.01, and 0.001 levels, respectively (1-tailed test).
All variables are calculated as defined in Table 2.2.

Conclusion

This study uses data from the US Air Transportation industry to investigate determinants of sticky cost behavior. Sticky cost behavior refers to asymmetric cost responses to changes in activity. The majority of the extant literature argues that sticky cost behavior arises when management does not fully adjust capacity to match changing sales volume (e.g., Anderson et al., 2003, 2007; Banker & Chen 2006). I argue that we can observe sticky cost behavior when management adjusts capacity and/or output selling price.

I provide evidence that airline industry capacity cost is sticky with respect to revenue change. Further, I find evidence that output quantity is not sticky with respect to sales volume, indicating that management matches capacity and sales volume as demand fluctuates. Additionally, I find that sticky costs are associated with marginal cost of adding capacity that exceeds the marginal benefit from removing capacity. Finally, I provide some evidence that sticky costs are associated with output selling price change. Specifically, using ASM to proxy for capacity, I find that management lowers output selling price faster than they increase it as demand fluctuates. This behavior is consistent with marginal benefit from removing ASM that decreases faster than the marginal cost of adding ASM increases.

This paper has cost accounting implications beyond simply explaining sticky cost behavior as an empirical phenomenon in the airline industry. I illustrate the importance of precision in which activity measures we use in our cost models if we wish to glean information about management decisions. For example, by using precise measures, I find

that sticky costs in the airline industry are associated with management adjusting output quantity and output selling price as opposed to leaving quantity unchanged as suggested by the extant literature (e.g., Anderson et al., 2003). Note that the specific empirical results from this study are not intended to be generalized across all costs and industries (i.e., it is possible that costs in other industries are sticky because management retains unused capacity). The implication of this study is that the inferences about management actions that we can draw from sticky costs are limited by the precision of our sticky cost models.

It is important to recognize what management actions are associated with sticky cost behavior because cost changes associated with different management actions may provide differing expectations for future earnings. For example, the incomplete matching explanation offered by the extant literature suggests that cost change relative to revenue is positively associated with future earnings during revenue-decreasing periods because management retains unused resources in anticipation of demand resurgence (Anderson et al., 2007). In contrast, sticky costs arising from changing marginal cost/benefit from capacity adjustment and output selling price changes may indicate that management has matched capacity and sales volume, reaching a new equilibrium. Or, if capacity adjustment is costly, it is possible that sticky costs indicate that management chose to *incur* adjustment cost by matching capacity with sales volume because the economic outlook is bleak. I leave the investigation of relationships between determinants of sticky cost behavior and expected future profitability to future research.

Appendix A

The instrumental variable for capacity unit cost change is derived by regressing firm-level changes on industry-level changes in average capacity unit cost together with firm-level proxies for production function changes.

$$\left(\frac{c_{i,t}-c_{i,t-1}}{c_{i,t-1}}\right)=\varsigma_0+\varsigma_1\left(\frac{\overline{c}_t-\overline{c}_{t-1}}{\overline{c}_{t-1}}\right)+\varsigma_2\left(\frac{fltlgth_{i,t}-fltlgth_{i,t-1}}{fltlgth_{i,t-1}}\right)+\varsigma_3\left(\frac{size_{i,t}-size_{i,t-1}}{size_{i,t-1}}\right)$$
$$+\varsigma_4\left(\frac{fltconc_{i,t}-fltconc_{i,t-1}}{fltconc_{i,t-1}}\right)+\varsigma_5\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)+\varsigma_6 DEC_{i,t}*\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)+\psi_{i,t} \quad (2.4)$$

Variables:

$\overline{c}_t$ = The industry average capacity unit cost at time *t*

$fltlth_{i,t}$ = The average flight length (in miles) for firm *i* at time *t*

$size_{i,t}$ = The average number of seats per aircraft for firm *i* at time *t*

$fltconc_{i,t}$ = A Herfindahl Index of fleet concentration for firm *i* at time *t*

Table A.1 reports descriptive statistics and data definitions for the production function variables used in equation 2.4. Table A.2 reports the first-stage regression results for the capacity unit cost change instrumental variable used in equation 2.2.

Appendix B

This appendix provides a mathematical derivation of the parameters found in equations 2.2 and 2.3. The firm subscript (*i*) is omitted for presentation purposes.

Table A.1

Descriptive Statistics and Data Definitions

Variable (N=509)	Variable Calculation	Description	Mean	Median	Std.	1st Quartile	3rd Quartile
Flight Length Change	$\left(\frac{fltlgth_{i,t} - fltlgth_{i,t-1}}{fltlgth_{i,t-1}}\right)$	Seasonally-adjusted change in average flight length (in miles) for firm i at time t	2.0%***	2.2%***	4.3 pts	0.5%	4.4%
Aircraft Size Change	$\left(\frac{size_{i,t} - size_{i,t-1}}{size_{i,t-1}}\right)$	Seasonally-adjusted change in average number of seats per aircraft for firm i at time t	(0.5%)***	0.1%*	2.7 pts	(1.6%)	1.1%
Fleet Concentration Change	$\left(\frac{fltconc_{i,t} - fltconc_{i,t-1}}{fltconc_{i,t-1}}\right)$	Seasonally-adjusted change in fleet homogeneity (Herfindahl Concentration Index) for firm i at time t	0.1%	0.0%	9.4 pts	(4.7%)	4.6%

*, **, and *** indicate significance at the p<0.05, 0.01, and 0.001 levels, respectively (2-tailed test).
- Throughout the sample time period, major airlines add and divest subsidiary airlines and engage in capacity purchase agreements. Subsidiary and capacity purchase agreement operations data, when available, were added to major airlines for all quarters in which subsidiary and capacity purchase agreement accounting performance was reflected in consolidated numbers to enhance comparability.

Table A.2

First-Stage Instrumental Variable Estimation – Capacity Unit Cost Change Instrumental Variable

$$\left(\frac{c_{i,t}-c_{i,t-1}}{c_{i,t-1}}\right)=\varsigma_0+\varsigma_1\left(\frac{\overline{c}_t-\overline{c}_{t-1}}{\overline{c}_{t-1}}\right)+\varsigma_2\left(\frac{fltlgth_{i,t}-fltlgth_{i,t-1}}{fltlgth_{i,t-1}}\right)+\varsigma_3\left(\frac{size_{i,t}-size_{i,t-1}}{size_{i,t-1}}\right)$$
$$+\varsigma_4\left(\frac{fltconc_{i,t}-fltconc_{i,t-1}}{fltconc_{i,t-1}}\right)+\varsigma_5\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)+\varsigma_6 DEC_{i,t}*\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)+\psi_{i,t} \quad (2.4)$$

Variable	Parameter	Expected Sign	Equation (A-1):
			Parameter (*t*-statistic)
Intercept	(ς_0)	(?)	0.009 (0.38)
$\left(\frac{\overline{c}_t-\overline{c}_{t-1}}{\overline{c}_{t-1}}\right)$	(ς_1)	(+)	0.561 (3.82)***
$\left(\frac{fltlgth_{i,t}-fltlgth_{i,t-1}}{fltlgth_{i,t-1}}\right)$	(ς_2)	(?)	0.338 (1.86)‡
$\left(\frac{size_{i,t}-size_{i,t-1}}{size_{i,t-1}}\right)$	(ς_3)	(?)	–1.057 (–3.43)***
$\left(\frac{fltconc_{i,t}-fltconc_{i,t-1}}{fltconc_{i,t-1}}\right)$	(ς_4)	(–)	–0.038 (–0.87)
$\left(\frac{q_{i,t}-q_{i,t-1}}{q_{i,t-1}}\right)$	(ς_5)	(–)	0.004 (0.03)
$DEC_{i,t}*\left(\frac{q_t-q_{t-1}}{q_{t-1}}\right)$	(ς_6)	(–)	–0.481 (–2.35)*
Adjusted R^2			*0.112*
Firm-quarters (N)			509

‡,*, **, and *** indicate significance at the p<0.10, 0.05, 0.01, and 0.001 levels, respectively (2-tailed test).
All variables are calculated as defined in Tables 2.2 and 2.6.

Incomplete Matching of Output Quantity and Sales Volume

Parameters θ_1 and $\theta_1 + \theta_2$ measure capacity utilization change when revenue is increasing and decreasing, respectively. For exposition, assume for now that capacity utilization change is the same in both periods $(\theta_2 = 0)$:

$$\theta_1 = \left(\frac{q_t - q_{t-1}}{q_{t-1}} \right) \Big/ \left(\frac{v_t - v_{t-1}}{v_{t-1}} \right) = \left(\frac{v_{t-1}}{q_{t-1}} \right) \left(\frac{q_t - q_{t-1}}{v_t - v_{t-1}} \right) \tag{2.5}$$

The sticky cost parameter θ_2 captures the difference in capacity adjustment between periods in which revenue is increasing and decreasing. Parameter θ_2 is negative when $((q_t - q_{t-1})/(v_t - v_{t-1}))$ is greater in periods of increasing revenue than in periods of decreasing revenue. This is consistent with management retaining unused capacity (failing to completely adjust *q* to match *v*) as revenue falls.

Changing Marginal Cost of/Benefit From Capacity Adjustment

Let total cost (C_t) be a function of committed fixed cost (Balakrishnan et al, 2010) and capacity unit cost excluding committed fixed cost (including variable, discretionary fixed, and adjustment costs):

$$C_t = CFC + AC_t \cdot q_t \tag{2.6}$$

Variables:

CFC = The average flight length (in miles) for firm *i* at time *t*

AC_t = The average number of seats per aircraft for firm *i* at time *t*

Parameters ϕ_1 and $\phi_1 + \phi_2$ measure the marginal cost of adding output quantity as revenue increases and the marginal benefit from reducing output quantity as revenue decreases, respectively. For exposition, assume for now that capacity unit cost is the same in both periods $(\phi_2 = 0)$:

$$\phi_1 = \left(\frac{C_t - C_{t-1}}{q_{t-1}}\right) \Big/ \left(\frac{q_t - q_{t-1}}{q_{t-1}}\right)$$

$$= \left(\frac{(CFC + AC_t * q_t) - (CFC + AC_{t-1} * q_{t-1})}{q_t - q_{t-1}}\right)$$

$$= \frac{(AC_t * q_t) - (AC_{t-1} * q_{t-1})}{q_t - q_{t-1}}$$

$$= \frac{(AC_t * (q_t - q_{t-1} + q_{t-1})) - (AC_{t-1} * q_{t-1})}{q_t - q_{t-1}}$$

$$= \frac{AC_t * (q_t - q_{t-1}) + (AC_t - AC_{t-1}) * q_{t-1}}{q_t - q_{t-1}}$$

$$= AC_t + (AC_t - AC_{t-1}) * \left(\frac{q_{t-1}}{q_t - q_{t-1}}\right) \tag{2.7}$$

The parameter estimate is constant across time and revenue conditions if the marginal cost of adding capacity is constant and equal to the marginal benefit from removing capacity. The second term is positive when increasing marginal cost of adding capacity causes average unit cost (excluding committed fixed cost) to increase with

greater output quantity. In contrast, the second term is negative when decreasing marginal benefit from removing capacity causes average unit cost (excluding committed fixed cost) to increase with lower output quantity. As a result, increasing marginal cost of adding capacity coupled with decreasing marginal benefit from removing capacity results in a negative sticky cost parameter ϕ_2.[17]

Output Selling Price Change

Parameters ϕ_3 and $\phi_3 + \phi_4$ measure total cost change relative to output selling price change when revenue is increasing and decreasing, respectively. For exposition, assume for now that this ratio is the same in both periods $(\phi_4 = 0)$:

$$\phi_3 = \left(\frac{C_t - C_{t-1}}{q_{t-1}}\right) \Big/ \left(\frac{p_t - p_{t-1}}{p_{t-1}}\right) = \left(\frac{C_t - C_{t-1}}{p_t - p_{t-1}}\right)\left(\frac{p_{t-1}}{q_{t-1}}\right) \tag{2.8}$$

The parameter captures management's tradeoff between adjusting capacity cost and output selling price. The sticky cost parameter ϕ_4 is negative when $((C_t - C_{t-1})/(p_t - p_{t-1}))$ is greater in periods of increasing revenue than in periods of decreasing revenue.[18] This is consistent with management lowering output selling price (as opposed to reducing cost) to a greater degree as demand falls than they raise selling price (as opposed to increasing cost) as demand grows.

[17] This assumes that the average capacity unit cost at time *t*-1 is less than the marginal cost of adding an additional unit of capacity and greater than the marginal benefit from removing a unit of capacity at time *t*. Violation of this assumption biases against sticky cost results.

[18] This assumes that the ratio of lagged output selling price to lagged output quantity (p_{t-1}/q_{t-1}) does not systematically vary between revenue-increasing and revenue-decreasing periods.

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CHAPTER 3

THE ASSOCIATION BETWEEN NONFINANCIAL DISCLOSURE AND FUTURE ECONOMIC BENEFITS: THE VALIDATING EFFECT OF VERIFIABLE DETAIL ON CREDIBILITY

Introduction

The purpose of this paper is to validate verifiable detail as a source of credibility in nonfinancial disclosures of customer retention strategy. Credibility implies that actual outcome is expected to match disclosed outcome. Credibility is established if the disclosure is costly to the sender (Spence, 1973). Disclosed verifiable detail may be a source of credibility by 1) committing management to a set of actions and 2) providing proprietary information to competitors. It is difficult to directly observe commitment and proprietary costs associated with verifiable detail. However, the validity of verifiable detail as a source of credibility can be inferred if *actual* outcome matches *disclosed* outcome. I provide evidence that verifiable detail is a valid source of credibility by associating changes in actual outcome with the presence of verifiable detail. I provide

two contributions to the voluntary disclosure literature. First, I use customer retention theory to establish a set of expected economic outcomes to validate the credibility of nonfinancial disclosure. Second, I find that verifiable detail is a valid source of credibility by associating it with future economic outcomes consistent with customer retention theory.

Disclosure provides firm constituents critical information requisite in assigning market value to a firm. *Voluntary* disclosure provides the opportunity to convey additional information that helps constituents evaluate the unique economic conditions of a firm un-captured by mandatory accounting requirements. Management can use voluntary disclosure to influence firm value (Verrecchia, 1983). They do this in two ways; through cost of capital, and by updating expected future cash flows. Literature has documented the former effect by associating precommitment to increased disclosure with changes in information asymmetry (e.g., Botosan & Harris, 2000; Leuz & Verrecchia, 2000). The literature has also documented the association between management earnings (and other financial) forecasts and future performance as a proxy for expected future cash flows (see Hirst, Koonce, & Venkataraman, 2008 for a survey of the management forecast literature).

Nonfinancial disclosure is qualitative information conveyed by management to market constituents. The literature has found that management makes extensive use of nonfinancial disclosure. Hutton, Miller, and Skinner (2003) and Baginski, Hassell, and Kimbrough (2004) find that approximately 50% of management forecasts are qualitative in nature. Also, Nichols (2009) reports that less than half of management announcements

contain financial information. The extensive use of nonfinancial disclosure suggests that it represents an important medium for management communication. However, there is relatively little research that associates nonfinancial disclosure with future performance (Hirst et al., 2008). The research shortfall may arise from a lack of established theoretical associations between nonfinancial variables and future performance. One way to address this problem is to identify a type of nonfinancial disclosure that, if credible, theoretically signals improved future performance. The voluntary disclosure of customer retention strategy provides such a setting.

Marketing theory suggests that customer retention results in a barrier to entry (e.g., Hibbard, Kumar, & Stern, 2001; Reichheld & Sasser, 1990). A barrier to entry (BTE) can be defined as an incumbent firm's cost advantage over potential competitors such that abnormal profits persist without attracting market entrants (Bain, 1956). Stigler (1964) defines cost advantage as an operating cost that must be borne by market entrants that is not borne by incumbent firms. Examples include customer relationships, supplier relationships, and innovation (Dickinson & Sommers, 2008). Production/purchasing efficiencies also provide a BTE if firms are unable to enter a market at an efficient scale (Bain, 1956). Potential competitors are firms that, ceteris paribus, would enter a market to pursue abnormal profits. In this study, a market is defined by a set of customers. Thus, potential competitors include existing firms within an incumbent's industry that may wish to attract its customers.

BTE strategy represents management's effort to establish a cost advantage over potential competitors. If potential competitors are not aware of the change in strategy,

then they will continue to enter the market until they become aware of the incumbent's cost advantage. Alternatively, if potential competitors are made aware of the strategy, then they will either: 1) enter the market with a counter-strategy offsetting the cost advantage, or 2) choose not to enter the market because they believe that the incumbent's cost advantage offsets any expected benefits from entry. Therefore, it behooves management to make competitors aware of the strategy if, and only if, they believe that they will respond by choosing *not* to enter the market (Barton & Waymire, 2004). Accordingly, *credible* voluntary disclosure of BTE strategy reveals information about management's expectation regarding the strategy's effectiveness.

Disclosures gain credibility if management incurs costs associated with the choice to disclose (Spence, 1973).[19] BTE strategy disclosure incurs two types of costs. First, Lundholm (1999) and others (e.g., Hirst, Jackson, Koonce, & Petroni, 2003; Hutton et al., 2003) suggest that ex post verification of forward-looking statements imposes cost on management by holding them responsible for disclosed actions. Second, potential competitors can use the disclosed proprietary information to create a counter-strategy offsetting the BTE as discussed above. Both of these costs increase in the level of verifiable detail provided by the disclosure. For example, consider a disclosure that describes a BTE associated with a customer retention program. This program can be expressed by activities such as the rollout of a new direct sales force, sales support program, and/or repeat purchase incentives. Each activity provides information that can

[19] There is literature that suggests that costless disclosure, "cheap talk," also influences outcome. For example, Farrell (1987) suggests that costless disclosure can lead to monopoly-like collusion in a marketplace. Farrell and Rabin (1996) suggest that costless disclosure may indirectly affect outcome, but not market efficiency.

be verified ex post and/or used by potential competitors, providing a basis for credibility. Alternatively, a disclosure may be limited to a statement that management is placing 'increased emphasis on customer retention,' which is difficult to verify and cryptic in its interpretation by competitors.

I use disclosures of customer retention strategy (found in 10-K annual reports) to investigate the effect of verifiable detail on the association between nonfinancial disclosure and future economic performance. I find that customer retention strategy disclosure is positively associated with changes in the persistence of positive abnormal performance when accompanied by verifiable detail. This result is consistent whether the firms disclose a *change* in, or an *ongoing* strategy, indicating that the disclosure itself contributes to the BTE. To illustrate this point, firms that credibly disclose a *change* will show improved performance due to: 1) the effects of changing strategy that would have occurred without disclosure, and 2) deterring competitors from entering the market by making them aware of an impending BTE (disclosure effect). In contrast, firms that credibly disclose an *ongoing* strategy will improve performance through the disclosure effect.[20] In conclusion, I find that, given the disclosure provides verifiable detail, the change in positive abnormal performance associated with firms that disclose a *change* in BTE strategy exceeds that of firms that disclose an *ongoing* strategy.

The remainder of Chapter 3 is organized as follows: Section 3.2 provides a review of relevant literature and develops hypotheses, section 3.3 describes the sample and research design, section 3.4 reports primary results, section 3.5 provides additional

[20] This assumes that the strategy was not transparent to external stakeholders prior to the disclosure. If the strategy was transparent, there would be no cost nor benefit to its disclosure (Spence, 1973).

analysis useful in interpreting primary results, and section 3.6 concludes and offers direction for further research.

Literature Review and Hypothesis Development

This study adds to a growing body of nonfinancial disclosure research by: 1) using BTE and customer retention theory to establish an expected set of ex post economic outcomes associated with credible nonfinancial disclosure and 2) identifying verifiable detail as a source of credibility for expected changes in future performance associated with nonfinancial disclosure.

Voluntary Disclosure

Corporate disclosure is requisite to an efficient market (Healy & Palepu, 2001). Disclosure regulation was instituted to provide "credible, transparent, and comparable financial information… to make sound investment and credit decisions" (Financial Accounting Standards Board). However, there is sufficient diversity between firms to invite supplementary voluntary disclosure to inform investment decisions.

Voluntary disclosure differs from *mandatory* disclosure in that it represents management's willingness to convey private information to influence firm value by reducing cost of capital and/or by informing expected future cash flows (Dye, 2001). A large literature has investigated the association between disclosure and the information asymmetry components of cost of capital (e.g., Botosan & Harris, 2000; Lang & Lundholm, 1996; Leuz & Verrecchia, 2000). This study contributes to the literature that describes the association between disclosure characteristics and expected future

performance. The majority of research in this area has focused on management forecasts. Hirst et al. (2008) provide a survey of the management forecast literature using a framework that relates forecast characteristics (managerial discussion, directional news, forecast horizon, etc) with forecast consequences (analyst forecast revisions, changes in firm value, etc). Although this study does not involve earnings forecasts, Hirst et al. provide a framework useful in describing its contribution. This paper examines the association between sources of credibility (disclosure characteristics) and future performance (a disclosure consequence) given the choice to disclose nonfinancial information.

Nonfinancial Voluntary Disclosure

There is discussion regarding the prevalent use of nonfinancial management disclosures. Hutton et al. (2003) and Baginski et al. (2004) report that approximately half of the management forecasts sampled between 1993 and 1997 provide qualitative and open-ended forecasts, as opposed to point and range forecasts. Using management announcement data between 2002 and 2007, Nichols (2009) observes that the number of nonfinancial disclosures exceeds the number of earnings guidance disclosures yet very few studies look at associations between nonfinancial disclosure and future performance. The lack of empirical work using nonfinancial disclosure is likely due to difficulty in establishing ex ante expectations regarding future outcome (Hirst et al., 2008). I contribute to the nonfinancial disclosure literature by focusing on customer retention strategy, which offers theoretical and empirical predictions regarding expected future

performance.

Working papers by Lu (2009) and Nichols (2009) begin to fill the void in nonfinancial disclosure research. Lu studies the association between levels of nonfinancial disclosure (quantity and qualities of 10-K management discussion) and firms' propensity to underinvest in positive net present value projects. In contrast, this study focuses solely on the credibility of 10-K customer retention strategy disclosure while Lu does not explicitly examine disclosure credibility and excludes strategy discussion from his sample. Nichols supplies evidence that proprietary cost provides credibility to nonfinancial disclosure. He associates the magnitude of positive market reactions with measures of proprietary cost. This study is similar to Nichols' working paper in that it investigates sources of credibility in nonfinancial disclosure given the choice to disclose.

Credibility of Voluntary Disclosure

Disclosure credibility is founded in signaling theory, which suggests that the voluntary release of private information must be costly to the sender for constituents to believe it (Spence, 1973). The voluntary disclosure literature identifies two sources of cost that apply to this study. The management forecast literature finds a market response, a proxy for credibility, to good news forecasts increases when forecasts are accompanied by 'verifiable forward-looking statements' (e.g., Hirst et al., 2003; Hutton et al., 2003; Lundholm, 1999; Petroni, Ryan, & Wahlen, 2001; Ryan, 1997). Hutton et al. attribute the results to costs incurred by management who issue statements that "commit managers to

meeting the earnings forecast in particular ways and reduces the ways in which they might manage earnings to achieve the forecast" (p. 870). I refer to these costs as 'commitment costs' in this paper. Hutton et al. define verifiable forward-looking statements as those that contain quantitative components whose realizations are reported through financial statements (i.e., revenue forecasts). In contrast, they contend that qualitative statements, soft talk, lack credibility because they cannot be verified.[21] I combine the concepts of verifiability and soft talk in this paper by measuring commitment costs using the disclosure of qualitative details that can be verified by parties external to the firm.

Verrecchia (1983), Verrecchia (2001), and Evans and Sridhar (2002) suggest that proprietary costs also lend credibility to voluntary disclosure. Proprietary costs refer to competitors' use of disclosed information to erode a disclosing firm's profits. Hayes and Lundholm (1996) show that there is a tradeoff in segment disclosure between informing the capital market about firm value and attracting competitors to abnormally profitable segments. Several empirical works provide evidence that management refrains from disclosing proprietary information. Harris (1998) finds a negative association between segment reporting and competitive forces (a proxy for proprietary costs). Botosan and Stanford (2005) and Berger and Hann (2007) use changes in segment reporting rules to provide evidence that firms withhold segment information in presence of proprietary costs. Other studies examine the association between proprietary cost and the choice to

[21] Hutton et al. (2003) find that soft talk disclosures are not associated with changes in firm value either directly or through interaction with earnings forecasts. They attribute their findings to a lack of verifiability through mandatory financial disclosure, an alternative hypothesis for this study.

disclose information in specific industry settings (e.g., Biotech: Guo, Lev, & Zhou, 2004; Research-intensive industries: Jones, 2007). These studies provide evidence that proprietary costs are an important determinant in voluntary disclosure decisions. This paper differs from the above literature in that it does not investigate the influence of proprietary costs on disclosure choice; it associates differences in future performance with variation in the level of proprietary information (verifiable detail) *given* the choice to disclose.

As mentioned earlier, Nichols (2009) investigates the interaction effect of proprietary cost on the market's response to nonfinancial disclosure. This paper differs from Nichols' in three ways. First, it does not use economic proxies for proprietary cost; such as market share, abnormal profitability, and book-to-market ratio. Nichols points out those economic proxies for proprietary cost may capture additional constructs associated with proprietary information. In contrast, this study uses the presence of verifiable strategy detail as a direct proxy for the level of proprietary information that management is willing to share. Second, this paper focuses on customer retention strategy, which offers theoretical and empirical predictions regarding positive future performance. Finally, the primary results in this study focus on variation in actual performance realizations, to avoid any implicit assumptions regarding ex ante market expectations about future changes in performance.

Barrier to Entry Disclosure

As mentioned in the introduction, a barrier to entry is defined as an incumbent firm's cost advantage over potential competitors such that abnormal profits persist without attracting market entrants (Bain, 1956). A cost advantage (in the context of a BTE) is an operating cost which must be borne by market entrants that is not borne by incumbent firms (Stigler, 1964). A BTE can also exist between firms that compete in the same product-market if competitors incur costs, not borne by incumbents, to persuade customers to switch suppliers. Consistent with BTE theory, prior research (Baginski, Lorek, Willinger, & Branson, 1999; Cheng, 2005; Lev, 1983; Waring, 1996) finds barrier to entry variables are positively associated with the persistence of abnormal performance. I rely on BTE and customer retention theory to form the ex ante expectation that the persistence of positive abnormal performance will increase, subsequent to credible disclosure of customer retention strategy.

Customer Retention Strategy as a Barrier to Entry

Customer retention strategy involves specific actions taken to encourage customers to make repeat purchases from an incumbent supplier. The relationship marketing literature provides extensive theoretical support for expected BTE cost advantages associated with customer retention strategy. First, customer retention is expected to lead to increased customer switching costs (Hibbard et al., 2001; Morgan & Hunt, 1994, 1999). Customer switching costs refer to costs that a customer must incur if they choose to change suppliers, including costs of information-gathering and/or

compensation for risks associated with an unprecedented purchase experience.[22] Competitors must entice customers with incentives to offset customer switching costs. Subsequently, relationship marketing theory suggests that long-term customer relationships create a price advantage to the incumbent firm resulting in a BTE cost advantage.

Relationship marketing theory also contends that customer retention leads to reduced per-customer transaction costs. Customer transaction costs refer to costs a firm incurs to complete a transaction with a customer. For example, a firm can incur marketing/promotion expense in making customers aware of and creating incentives to purchase its products. Transaction cost investments are expected to become more efficient relative to potential competitors (creating a BTE cost advantage) as customer retention increases because firms can leverage knowledge and awareness gleaned from a long transaction history (Reichheld & Sasser, 1990; Srivastava, Shervani, & Fahey, 1998).[23]

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[22] Sources of equivalent information may include product reviews, consumer reports, word-of-mouth inquiries, and initial purchases. Compensation for switching costs may also include price and promotion incentives.

[23] There is anecdotal evidence in addition to theoretical support suggesting that customer retention is associated with reduced customer transaction costs. For example, Pinnacle Entertainment, Inc. reports in their 2005 10-K, "We anticipate such [marketing and promotional] costs declining in the future. Generally, the cost to retain customers is less expensive than attracting new customers" (p. 33). Additionally, The Allstate Corporation reports in their 2003 10-K, "As is true for the industry in general, costs attributable to our personal property and casualty products are generally higher during the first year an insurance policy is in effect than in subsequent years…. Policies become more profitable over time. Accordingly, customer retention is an important factor in the segment's profitability and a key element of our strategy in this business" (p. 3).

Hypotheses

I use two samples of firms that disclose customer retention strategy in this paper. The first sample of firms discloses a *change* in customer retention strategy (change firms) while the second sample discloses an *ongoing* customer retention strategy (ongoing firms). Both samples are dichotomously subdivided based on whether or not they provide verifiable detail in their disclosure. In combination, the samples provide extensive variation in the credibility of firms that have chosen to disclose strategy.

A *change* in customer retention strategy represents management's effort to *create* a cost advantage over potential competitors. Change firms that are willing to incur commitment and risk proprietary costs by making the market aware of a customer retention strategy *before* its cost advantages have been established, provide credible information about expected future performance. By disclosing verifiable details, change firm management incurs commitment costs associated with an implicit contract to invest resources *and* risks proprietary costs by revealing strategy *before* it has been implemented. If potential competitors believe that the change in strategy is credible, then they will either: 1) enter the market with a counter-strategy to preempt the cost advantage, or 2) choose not to enter the market because they believe that the incumbent will achieve its cost advantage regardless of counter-strategy. By providing verifiable detail, management signals that they believe that competitors will respond by choosing *not* to enter the market (Barton & Waymire, 2004) resulting in an increase in the

persistence of positive abnormal performance.[24]

H3.1: Firms that disclose a change in customer retention strategy using verifiable detail have a greater change in the persistence of positive abnormal performance than firms that disclose a change in customer retention strategy without verifiable detail.

The ongoing firm sample represents a group of managers who choose to disclose information about an existing strategy.[25] Similar to change firms, management can provide information about expected future performance by incurring commitment and risking proprietary costs. Management incurs commitment costs by revealing verifiable detail about a strategy for which they can now be held responsible.[26] Additionally, verifiable detail lends credibility by providing proprietary information to competitors. If potential competitors are made aware of an *ongoing* customer retention strategy, then they will either: 1) use the disclosed information to form a counter-strategy, eroding any cost advantage, or 2) choose not to enter the market because they believe that the incumbent's cost advantage offsets the benefit of pursuing abnormal profits. By providing verifiable detail, management signals that they believe that competitors will

[24] The 10-K disclosure provides a proxy for management's willingness to share information through an overall disclosure strategy. Management may disclose strategic information through a portfolio of media, including press releases, conference calls, and/or Securities and Exchange Commission filings.
[25] This paper assumes that the barrier has already been established at the time of the *ongoing* strategy disclosure. However, it is possible that management discloses the strategy after the strategy has been implemented but before the full economic effects of the barrier have been realized. In this case, the difference between the samples is diminished, biasing against results for hypothesis 3.3.
[26] This assumes that the strategy was not transparent to external stakeholders prior to the disclosure. If the strategy was transparent, there would be no cost nor benefit to its disclosure (Spence, 1973).

respond by choosing *not* to enter the market. Deterred competitive entry further establishes the BTE, increasing the persistence of positive abnormal performance. In contrast, if potential competitors are unaware of a firm's customer retention strategy then they will continue to enter the market in pursuit of abnormal profits.[27] Unlike change firms, the ongoing strategy has presumably already yielded a cost advantage; therefore, changes in performance can be associated with the disclosure effect of dissuading potential competitors from entering the market.

H3.2: Firms that disclose an ongoing customer retention strategy using verifiable detail increase the persistence of positive abnormal performance relative to firms that disclose an ongoing customer retention strategy without verifiable detail.

Finally, credible change firms differ from credible ongoing firms in two ways. First, it is possible that credible change firms would have increased performance whether or not they disclosed the change in strategy.[28] Conversely, credible ongoing firms presumably have already established a cost advantage at the time of the disclosure. Second, change firms risk greater proprietary costs than ongoing firms because the BTE cost advantage for change firms has not yet been established. Competitors of change firms have an opportunity to use the disclosed proprietary information to *preempt* the

[27] This statement assumes that potential competitors cannot directly observe firms' cost advantage. That is, competitors do not attribute abnormal performance to a BTE cost advantage such as relationship-based customer switching costs.

[28] The change in strategy may be in response to poor performance and/or adverse market conditions. Therefore, the "increase" in performance is relative to expected performance without credible disclosure, modeled using a matched-pair design.

change in strategy whereas competitors of ongoing firms can only *react* to an existing strategy. If change firms are willing to risk greater proprietary costs than ongoing firms then they must expect greater performance improvements associated with disclosure. These differences lead to a third hypothesis that the improvement in future performance for change firms exceeds that of ongoing firms given that both groups disclose verifiable detail.

H3.3: Firms that disclose a change in customer retention strategy using verifiable detail have a greater increase in the persistence of positive abnormal performance than firms that disclose an ongoing customer retention strategy using verifiable detail.

Sample Selection and Research Design

Sample Selection

Table 3.1 numerically describes the sample selection process. The sample initially includes all firms with available data in Compustat from 1994 through 2008. The sample period begins in 1994 due to the availability of online 10-K filings for collection of disclosure information. Firms in regulated industries are excluded due to potentially confounding effects of regulation on customer retention strategy and performance.[29] The sample is further reduced by searching 10-K filings for firms that disclose customer retention strategy. Initially, candidate firms are identified using three word strings:

[29] Regulated industries include Utilities (4-digit NAICS 2211-2213) and Telecommunications (5131-5133, 5151-5152, 5171-5179) firms.

Table 3.1

Sample Selection

Reduction	Total Firms	Total Firm-years
Economy (1994 – 2008)	18,334	156,328
No regulated industries[1]	(1,193)	(10,556)
Subtotal unregulated Economy	17,141	145,772
Missing, zero or negative Sales and Cost of Goods Sold; missing Earnings before Interest and Taxes; Missing Market Value	(3,213)	(39,013)
Available Data	13,928	106,759
No reference to key words	(12,891)	(96,575)
Reference to key words	1,037	10,184
Fewer than 7 observations, at least 2 years preceding/following disclosure[2]	(484)	(3,643)
Total available key word sample	553	6,541
Nonstrategic key word references	(437)	(5,193)
Total referencing customer retention strategy	116	1,348
Outliers[3]	(18)	(189)
Total Sample	**98**	**1,159**
Subsample: Verifiable change in customer retention strategy	18	217
Subsample: Nonverifiable change in customer retention strategy	23	285
Subsample: Verifiable ongoing customer retention strategy	15	164
Subsample: Nonverifiable ongoing customer retention strategy	42	493
Total Sample Firm-years limited to 4 preceding and 4 subsequent to disclosure year[c]	**98**	**766**
Subsample: Verifiable change in customer retention strategy	18	141
Subsample: Nonverifiable change in customer retention strategy	23	185
Subsample: Verifiable ongoing customer retention strategy	15	118
Subsample: Nonverifiable ongoing customer retention strategy	42	321

Table 3.1 (continued)

[1] This paper removes the Utilities (4-digit NAICS 2211–2213) and Telecommunications (5131–5133, 5151–5152, 5171–5179) industries where competition is likely to be influenced by regulation. For example, Federal Communications Commission (FCC) regulation allows customers to keep phone numbers when changing service providers, significantly changing customers' switching costs. Quoting the most recent FCC press release, "Delays in number porting cost consumers money and impede their ability to choose providers based solely on price, quality and service (2009)."

[2] Firms with missing observations within the 7-year window around the disclosure (+/- 2 years) are dropped. The earliest observation is lost due to the auto-regressive nature of the hypothesis tests.

[3] Outliers: Firms with influential observations were identified using studentized residuals greater than three or less than –3. Each firm is examined to determine whether influential observations are associated with changes in performance unrelated to the disclosed customer retention strategy. All firm observations (influential or otherwise) are dropped if the firm's influential observations are not clearly associated with the disclosed customer retention strategy and the observation is within a 2-year window around the disclosure year. Individual influential firm-year observations are dropped (as opposed to all firm observations) in cases where the observations fall outside of the 2-year window around the disclosure year.

Detailed descriptions of dropped firms/observations follow:

- Meditrust merged with La Quinta in 1998 (2 years prior to the disclosure year) substantially changing the firm's cost structure. All observations are dropped.
- Prior to 1997 (2 years prior to the disclosure year), Illinois Superconductor Corporation provided a large proportion of its R&D investment based on government contracts. After 1997, the government contracts were terminated substantially changing the firm's cost structure. All observations are dropped.
- In 2007 and 2008 (3-4 years subsequent to disclosure), Hanmi Financial incurred substantial (~30% of revenue) impairment expenses associated with Goodwill. 2007 and 2008 firm-year observations are dropped.
- In 2006 (2 years subsequent to disclosure), AXS-One discontinued its Enterprise Solutions product line substantially decreasing revenue (~65% decrease). All observations are dropped.
- youbet.com was in start-up phase during the 3 years leading up to the disclosure year. First revenue appeared part-way through 1998. During this same time, youbet.com incurred substantial start-up operating expenses (370% - 4300% of revenue). All observations are dropped.
- Prior to 2001 (2 years prior to disclosure), Stage Stores restructured as part of Chapter 11 Bankruptcy. Observations prior to 2001 (3-4 years prior to disclosure) are dropped.
- iLinc Communications discontinued its dental practice software suite in 2003 (the disclosure year), significantly influencing revenue and cost structure. All observations are dropped.
- VA Software discontinued its Professional Services and Linux software engineering divisions in fiscal 2002 (2 years prior to disclosure) due to economy-driven poor operating performance, significantly influencing revenue and cost structure. All observations are dropped.
- In 1999 (2 years prior to disclosure), Safeguard Health Enterprises recorded an unusually large asset impairment disproportionately inflating general and administrative expense. All observations are dropped.
- In 1998 (4 years prior to disclosure), Matria Healthcare performed the significant acquisition of Quality Diagnostic Services. In 2004 (2 years subsequent to disclosure), they discontinued the direct-to-consumer pharmacy and supplies division decreasing approximately2/3^{rds} of its revenue. All observations are dropped.

Table 3.1 (continued)

[3] Outliers: (Continued)

- In 2000 (one year subsequent to disclosure), ECCS lost a substantial portion (~80%) of government contract revenue due to a federal investigation into Air Force purchasing. All observations are dropped.
- In 2005 (2 years subsequent to disclosure), Mediabay lost a substantial portion (~40%) of subscription revenue due to a change in renewal policy from auto-renewal to customer-initiated renewals. Note: This verifiable change in strategy is not explicitly described in the nonverifiable customer retention disclosure 2 years prior. The results (if the firm is included in the sample) would imply that nonverifiable firms are associated with poor future performance relative to verifiable firms. However, the results are explicitly confounded by a subsequent change in customer-related strategy. All observations are dropped.
- In 2001 (2 years prior to disclosure), Onvia discontinued its low-margin business-to-business segment. All Onvia observations are dropped.
- In 1999 and 2000 (3 and 2 years prior to disclosure), Precision Auto Care recorded an unusually large amount of bad debt expense and litigation expense disproportionately inflating general and administrative expense. All observations are dropped.
- In 2005 (2 years subsequent to disclosure), Prologis underwent a substantial acquisition (>100% increase in revenue) of Catellus. All observations are dropped.
- In 1999 (thee years prior to disclosure), A.D.A.M. added an internet segment substantially changing is cost model. Observations prior to and including 1999 are dropped.
- In 2005, (2 years subsequent to disclosure), GS Financial recorded a substantial (~50% if revenue) provision for loan losses associated with Hurricane Katrina. All observations are dropped.
- In 2001, (the disclosure year), Gametech International recorded a substantial (5% of revenue) onetime charge for the launch of a new product. All observations are dropped.
- In 2001 and 2002 (2-3 years prior to disclosure), Bottomline Technologies recorded substantial (40-45% of revenue) impairment expenses associated with intangible assets. All observations are dropped.
- In 2002 (2 years prior to disclosure), Intraware established a strategic relationship with iPlanet E-Commerce Solutions, significantly changing the structure of revenue/costs. All observations are dropped.

"customer retention," "retain customer," and "relationship marketing." Each filing containing one or more word strings is read in detail to determine whether the disclosure references customer retention strategy; and further subcategorized based on whether it describes a change, in or an ongoing strategy. A selection of excerpts from disclosures and justification for coding from each subsample is included in the Appendix.[30] Several firms issue multiple disclosures during the sample period that include a word string. In these cases, the first chronological occurrence is classified as the disclosure year. This is done to provide a predisclosure baseline free of customer retention strategy changes. Table 3.2 provides a detailed breakdown of industry and disclosure year timing.

Earnings persistence is estimated using an autoregressive model, so each firm is required to have at least seven firm-year observations, with at least two preceding and two subsequent to the disclosure year. The 7-year requirement may bias the sample towards surviving firms. However, it is requisite to ensure statistical power to identify postdisclosure change in earnings persistence relative to predisclosure performance.

Firms with influential observations are evaluated to determine whether the economics explicitly relate to the disclosed customer retention strategy.[31] This is done through examination of the management discussion relating to observations' financial performance. If the influential observations fall within a plus/minus 2-year window around the disclosure *and* do not explicitly relate to customer retention strategy, then all observations for the firm are dropped. If the influential observations fall 3- to 4-years

[30] Coding justification for the remaining firms is available upon request from author.
[31] Influential observations are identified using studentized residuals whose absolute value is greater than three. Residuals are collected from estimating each subsample's abnormal ROS equation 3.2.

Table 3.2

Number of Customer Retention Strategy Disclosures by Year and Industry

N=98 Firms	Disclosure Year[1]									
2-digit NAICS Code	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total Firms
23 – Construction						3				3
31-33 – Manufacturing		2		1		3	3	1	2	12
42 – Wholesale Trade						2	1	2		5
44-45 – Retail Trade	2	1	2			3	5			13
48 – Transportation and Warehousing					1	1				2
51 – Information			1		2	1	1			5
52 – Finance and Insurance	1	2	1	3	4	14	5	5	2	37
53 – Real Estate, Rental and Leasing						1				1
54 – Professional, Scientific, and Technical Services						4				4
56 – Administrative and Support, Waste Management, and Remediation Services		1				2		1	2	6
61 – Educational Services									1	1
62 – Health Care and Social Assistance					1	1				2
71 – Arts, Entertainment, and Recreation		1				1			1	3
81 – Other Services				1			1			2
99 – Unclassified						1	1			2
Total # of Firms	3	7	4	5	8	37	17	9	8	98

NAICS Industry codes and descriptions taken from the 2007 updated North American Industry Classification System.
Disclosure Years reference firm fiscal years.
[1] The Disclosure Year references the first chronological occurrence in which a firm discloses customer retention strategy.

prior to or subsequent to disclosure *and* do not explicitly relate to customer retention strategy, then only the observations outside of the 2-year window around disclosure are dropped. Of the 116 firms identified as disclosing customer retention strategy, 18 firms are dropped due to noncustomer retention strategy-related firms are dropped due to noncustomer retention strategy-related influential observations. Details regarding the dropped observations are included in the footnotes to Table 3.1.

Finally, each firm that discloses customer retention strategy is classified according to whether it provides verifiable detail. This paper uses a binary coding method for assessing the levels associated with each disclosure. Disclosure is classified as having verifiable detail if it contains statements that describe the nature of the change in strategy *and* the change can be verified by a constituent external to the firm (e.g., investor, competitor). For example, a disclosure that states "the Company's strategy is to grow the business through improved customer retention" *does not* provide sufficient descriptive information to be coded as containing verifiable detail. In contrast, a disclosure that states, "the Company is currently beginning the chain wide rollout of its new relationship marketing program, the Customer Appreciation Card" *does* provide sufficient detail that can be verified by observing card-carrying customers. Finally, a disclosure that states "the Company believes the implementation of the customer tracking system will help us retain customers. We use our research data to tailor promotional offers to the specific tastes of targeted customers" *does* provide detail regarding the strategic change. Conversely, the existence of the customer-profiling database *cannot* be verified by entities external to the firm. This final example would be coded as *not* containing

verifiable detail.[32]

The final sample is comprised of 98 firms. Forty-one firms disclose a *change* in strategy (18 provide verifiable detail, 23 do not). Fifty-seven firms disclose an *ongoing* strategy (15 provide verifiable detail, 42 do not). The analysis discussed in the following sections uses no more than 9 firm-years per firm (4 years prior to and subsequent to disclosure). The constrained time horizon is used to minimize confounding effects associated with other (nonBTE related) changes in strategy but still provide adequate time to establish a predisclosure baseline and identify postdisclosure change.[33]

Variable Definition and Descriptive Statistics

Performance Variables

As discussed previously, customer retention is associated with persistent positive abnormal performance due to increased customer switching costs (Hibbard et al., 2001; Morgan & Hunt, 1994, 1999) and lower customer transaction costs (Reichheld & Sasser, 1990; Srivastava et al., 1998). This paper uses three measures of abnormal performance designed to separate price premiums due to customer switching costs from customer transaction cost advantages. Abnormal performance is measured by return on sales (earnings before interest and taxes divided by net revenue), gross margin (1–cost of goods sold divided by net revenue), and selling, general and administrative margin (1–

[32] Examples are based on the 2002 10-K for Matria Healthcare, Inc; 2000 10-K for Caremark Corp; and 2003 10-K for Riviera Holdings Corp. Wording is adapted for illustration.
[33] Alternative sample windows are used in additional analysis provided in section 3.5.

selling, general, and administrative expense divided by net revenue).[34,35] Abnormal return on sales (ROS) accounts for sales relative to all operational costs; capturing price premiums, customer transaction cost efficiencies, and any other production/purchasing and SGA efficiencies. Abnormal gross margin (GM) accounts for sales relative to cost of goods sold; capturing price premiums and production/purchasing efficiencies, *without* capturing customer transaction cost or other SGA efficiencies. Lastly, selling, general and administrative margin (SGA Margin) captures price premiums, customer transaction cost efficiencies, and other SGA efficiencies *without* capturing production/purchasing efficiencies.

Each performance variable is measured relative to its closest competitor by matching firms based on 4-digit NAICS industry, the natural log of market value of equity (firm size), and predisclosure performance.[36,37] This design is used in lieu of industry-adjusted performance because it accounts for within-industry differences in profitability that are not indicative of economic performance. To illustrate, a large firm may have an abnormally large proportion of industry profits while its ROS falls below the industry mean. Matching on size resolves this issue. Similarly, there may be

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[34] Previous cost accounting literature (e.g., Abarbanell & Bushee, 1997; Anderson, Banker, Huang, & Janakiraman, 2007; Anderson, Banker, & Janakiraman, 2003) has used a similar measure of efficiency, the SGA cost ratio (selling, general and administrative expense divided by net revenue).

[35] Selling, general, and administrative expense is defined as all costs included in earnings before interest and taxes (EBIT) except cost of goods sold. This definition is used so that all EBIT cost components are included in either the GM or SGA Margin measures.

[36] In 1997, the North American Industry Classification System (NAICS) was adopted to replace Standard Industry Classifications (SIC). NAICS definitions offer a cohesive, up-to-date industry definition (Krishnan & Press, 2004).

[37] Comparator firms are examined for unusual postdisclosure activity (such as acquisitions/dispositions that significantly alter performance). The next best match is selected when a comparator is found to have confounding postdisclosure activities.

substantial diversity in COGS and SGA investment mix within an industry, resulting in mis-leading interpretations of industry-adjusted GM and SGA Margin. Matching on predisclosure GM and SGA Margin performance mitigates this problem. Matching on industry controls for temporal effects on profitability (assumed to be constant across similarly-sized firms within an industry).

Table 3.3 Panel A provides descriptive statistics for the variables used in the primary analysis. None of the mean abnormal performance measures are significantly different than zero. This is likely due to the predisclosure performance (GM and SGA Margin) matching criteria used to identify benchmark firms. The performance measures' standard deviations for the verifiable detail subsamples are lower than the standard deviations for the nonverifiable subsamples. This is consistent with the verifiable detail subsamples having greater persistence than the nonverifiable detail subsamples.

Table 3.3 Panel B provides average abnormal performance for each year beginning 4 years prior through 4 years subsequent to the disclosure year. The verifiable change and ongoing firms' abnormal performance appears to increase (albeit statistically insignificantly) slightly from before to after the disclosure year across all performance measures except GM (ongoing firms). In contrast, the nonverifiable change firms' abnormal GM becomes significantly positive ($p<0.05$, $p<0.10$) in the last couple of years, offset by significantly negative ($p<0.05$, $p<0.05$) SGA Margin. The nonverifiable ongoing firms' abnormal SGA Margin becomes significantly negative ($p<0.10$, $p<0.05$) without any offsetting increase in performance in GM.

Table 3.3 Panel C reports Pearson and Spearman correlations among variables.

Table 3.3

Descriptive Statistics for Firms that Disclose Customer Retention Strategy

Panel A – Descriptive Statistics

Variable	Samples	# Firms	Mean	Median	1st Quartile	3rd Quartile	Std Deviation
Performance Variables							
Abnormal Return on Sales	Total Sample	98	(0.4%)	(0.0%)	(3.6%)	2.3%	7 points
	Subsamples:						
	Verifiable Change	18	(0.4%)	0.2%	(3.6%)	2.6%	4 points
	Nonverifiable Change	23	0.3%	0.6%	(3.3%)	5.1%	9 points
	Verifiable Ongoing	15	(1.2%)	(1.3%)	(3.8%)	0.7%	7 points
	Nonverifiable Ongoing	42	(0.6%)	(0.1%)	(3.9%)	2.3%	8 points
Abnormal Gross Margin	Total Sample	98	1.0%	0.0%	(2.9%)	5.0%	11 points
	Subsamples:						
	Verifiable Change	18	0.4%	0.2%	(4.3%)	6.2%	6 points
	Nonverifiable Change	23	1.2%	1.5%	(2.1%)	6.4%	15 points
	Verifiable Ongoing	15	(0.8%)	(0.8%)	(2.9%)	0.9%	6 points
	Nonverifiable Ongoing	42	1.6%	(0.1%)	(3.4%)	8.6%	12 points
Abnormal Selling, General, and Administrative Margin	Total Sample	98	(1.4%)	(0.1%)	(3.5%)	1.7%	11 points
	Subsamples:						
	Verifiable Change	18	(0.9%)	(0.4%)	(4.5%)	2.5%	7 points
	Nonverifiable Change	23	(0.9%)	(1.1%)	(7.8%)	1.7%	11 points
	Verifiable Ongoing	15	(0.5%)	0.4%	(2.0%)	1.3%	3 points
	Nonverifiable Ongoing	42	(2.2%)	0.0%	(3.7%)	2.3%	14 points
Control Variables							
Market Share (%)	Total Sample	98	6.7%	0.7%	0.0%	6.4%	14 points
	Subsamples:						
	Verifiable Change	18	8.6%	2.0%	0.0%	9.6%	13 points
	Nonverifiable Change	23	5.5%	1.0%	0.3%	3.3%	15 points
	Verifiable Ongoing	15	4.5%	0.8%	0.1%	9.1%	7 points
	Nonverifiable Ongoing	42	7.4%	0.3%	0.0%	5.3%	17 points

Table 3.3 (Continued)

Panel A – Descriptive Statistics (Continued)

Variable	Samples	# Firms	Mean	Median	1st Quartile	3rd Quartile	Std Deviation
Control Variables							
Herfindahl Concentration Index (0–100 scale)	Total Sample	98	21.0	16.9	6.4	25.9	16.5
	Subsamples:						
	Verifiable Change	18	19.3	16.5	10.2	26.2	11.0
	Nonverifiable Change	23	19.3	17.5	6.4	24.7	13.3
	Verifiable Ongoing	15	25.2	20.2	14.2	29.7	16.3
	Nonverifiable Ongoing	42	21.1	16.3	6.4	24.4	20.0
Number of Firms in NAICS4 Industry	Total Sample	98	249	65	25	615	289
	Subsamples:						
	Verifiable Change	18	212	56	27	277	282
	Nonverifiable Change	23	227	54	35	512	276
	Verifiable Ongoing	15	155	46	19	208	236
	Nonverifiable Ongoing	42	310	184	25	694	311
Acquisition Indicator Variable (0/1)	Total Sample	98	0.36	0.29	0.11	0.56	0.32
	Subsamples:						
	Verifiable Change	18	0.45	0.38	0.22	0.78	0.32
	Nonverifiable Change	23	0.35	0.38	0.11	0.56	0.27
	Verifiable Ongoing	15	0.32	0.14	0.11	0.50	0.34
	Nonverifiable Ongoing	42	0.33	0.24	0.00	0.56	0.35
Matching Variable							
Market Value of Equity ($ mils)	Total Sample	98	4,786	419	72	2,663	18,836
	Subsamples:						
	Verifiable Change	18	5,121	610	125	4,916	8,881
	Nonverifiable Change	23	5,622	793	70	6,751	10,710
	Verifiable Ongoing	15	12,226	405	51	896	45,440
	Nonverifiable Ongoing	42	1,527	330	68	2,087	2,923

Table 3.3 (Continued)

Panel B – Mean Values by Year

Variable		4 yrs prior	3 yrs prior	2 yrs prior	1 yr prior	Disclosure yr	1 yr after	2 yrs after	3 yrs after	4 yrs after
Performance Variables										
# of Firms	Total Sample	79[a]	91[b]	98	98	98	98	98	76[c]	57[d,e]
	Subsamples:									
	Verifiable Change	13	15	18	18	18	18	18	15	13
	Nonverifiable Change	19	20	23	23	23	23	23	21	17
	Verifiable Ongoing	12	15	15	15	15	15	15	12	9
	Nonverifiable Ongoing	35[a]	41	42	42	42	42	42	28	18
Mean Abnormal Return on Sales	Total Sample	0.8%	(1.2%)	(0.3%)	0.8%	0.4%	(1.2%)	(1.5%)	(0.6%)	(0.8%)
	Subsamples:									
	Verifiable Change	0.6%	(2.2%)	(0.8%)	(1.1%)	(0.8%)	0.6%	0.7%	0.4%	(0.2%)
	Nonverifiable Change	1.6%	2.6%	(0.1%)	0.1%	0.6%	(1.6%)	(0.6%)	1.5%	(0.6%)
	Verifiable Ongoing	2.0%	(5.2%)	(3.0%)	(0.5%)	(1.4%)	(1.3%)	0.0%	(1.4%)	2.5%
	Nonverifiable Ongoing	(0.1%)	(1.2%)	0.6%	2.4%	1.6%	(1.8%)	(3.4%)	(2.4%)	(3.1%)
Mean Abnormal Gross Margin	Total Sample	(0.3%)	(0.1%)	1.2%	1.5%	0.6%	0.6%	1.3%	2.3%‡	2.1%
	Subsamples:									
	Verifiable Change	0.1%	(0.9%)	1.2%	(0.3%)	(0.1%)	0.7%	0.5%	0.5%	(0.5%)
	Nonverifiable Change	(2.4%)	(0.0%)	(1.6%)	(0.2%)	0.5%	2.2%	3.4%	7.2%*	6.0%‡
	Verifiable Ongoing	1.8%	(1.9%)‡	(0.1%)	(0.9%)	(0.5%)	(1.4%)	(0.6%)	(2.2%)	(0.1%)
	Nonverifiable Ongoing	(0.1%)	0.8%	3.3%	4.0%‡	1.5%	0.3%	1.2%	1.6%	1.3%
Abnormal Selling, General, and Administrative Margin	Total Sample	1.1%	(1.1%)	(1.6%)	(0.7%)	(0.2%)	(1.8%)	(2.8%)	(2.9%)*	(2.9%)*
	Subsamples:									
	Verifiable Change	0.5%	(1.3%)	(2.0%)	(0.8%)	(0.7%)	(0.1%)	0.2%	(0.2%)	0.3%
	Nonverifiable Change	4.0%	2.7%	1.6%	0.3%	0.1%	(3.8%)	(4.0%)	(5.7%)*	(6.6%)*
	Verifiable Ongoing	0.2%	(3.3%)	(2.9%)	0.3%	(0.9%)	0.1%	0.6%	0.8%	2.7%
	Nonverifiable Ongoing	(0.0%)	(2.0%)	(2.6%)	(1.6%)	0.1%	(2.1%)	(4.6%)	(4.0%)‡	(4.4%)*
Control Variables										
Mean Market Share (%)	Total Sample	6.1%	6.8%	7.2%	7.1%	7.1%	7.2%	7.2%	6.5%	6.9%
	Subsamples:									
	Verifiable Change	9.3%	9.0%	8.4%	8.7%	9.0%	9.4%	9.4%	11.4%	12.7%
	Nonverifiable Change	4.4%	4.1%	6.8%	6.7%	6.7%	6.7%	6.9%	2.0%	2.4%
	Verifiable Ongoing	5.0%	4.7%	4.5%	4.3%	4.3%	4.1%	5.0%	3.5%	4.6%
	Nonverifiable Ongoing	6.3%	8.1%	7.8%	7.7%	7.5%	7.5%	7.3%	8.4%	8.0%

Table 3.3 (Continued)

Panel B – Mean Values by Year (Continued)

Variable		4 yrs prior	3 yrs prior	2 yrs prior	1 yr prior	Disclosure Yr	1 yr after	2 yrs after	3 yrs after	4 yrs after
Control Variables										
Mean Herfindahl Concentration Index (0–100 scale)	Total Sample	24.1	22.3	21.2	20.9	20.2	19.5	18.4	16.8	15.8
	Subsamples:									
	Verifiable Change	25.2	21.2	20.2	19.4	18.0	17.9	16.8	17.3	15.7
	Nonverifiable Change	23.2	22.4	19.5	18.5	18.9	17.5	16.2	14.4	13.4
	Verifiable Ongoing	27.6	26.5	26.5	25.2	23.5	23.2	21.3	18.6	15.4
	Nonverifiable Ongoing	23.0	21.2	20.7	21.4	20.6	20.6	19.3	17.6	18.4
Mean Number of Firms in NAICS4 Industry	Total Sample	214	247	256	261	264	258	244	213	207
	Subsamples:									
	Verifiable Change	163	245	215	219	217	216	206	142	128
	Nonverifiable Change	188	199	228	238	250	243	233	243	250
	Verifiable Ongoing	157	158	158	160	162	160	150	119	136
	Nonverifiable Ongoing	268	304	323	327	328	319	300	269	260
Mean Acquisition Indicator Variable (0/1)	Total Sample	0.39	0.36	0.29	0.32	0.45	0.44	0.40	0.36	0.39
	Subsamples:									
	Verifiable Change	0.54	0.47	0.33	0.50	0.50	0.50	0.61	0.53	0.54
	Nonverifiable Change	0.32	0.40	0.35	0.26	0.30	0.52	0.43	0.33	0.35
	Verifiable Ongoing	0.42	0.40	0.33	0.27	0.40	0.33	0.27	0.25	0.33
	Nonverifiable Ongoing	0.37	0.29	0.21	0.29	0.52	0.36	0.33	0.32	0.33
Matching Variable										
Market Value of Equity ($ mils)	Total Sample	2,989	3,576	4,285	5,427	6,108	5,580	6,576	8,951	10,394
	Subsamples:									
	Verifiable Change	4,153	3,565	3,850	3,671	5,144	6,248	7,102	13,276	11,791
	Nonverifiable Change	4,167	5,807	4,599	5,981	6,605	6,386	7,518	7,978	9,300
	Verifiable Ongoing	5,340	7,710	12,813	17,443	17,898	12,747	17,665	21,630	27,591
	Nonverifiable Ongoing	1,112	979	1,254	1,585	2,039	2,294	1,875	1,928	1,819

Table 3.3 (Continued)

Panel C – Pearson (Spearman) correlation on the upper (lower) diagonal

N=766	ROS	GM	SGA Margin	Market Share	Herfindahl Index	# of Firms in Industry	Acquisition Indicator	Market Value
Abnormal Return on Sales (ROS)		0.299 ***	0.476 ***	0.049	–0.001	–0.005	–0.023	0.104 **
Abnormal Gross Margin (GM)	0.469 ***		–0.697 ***	–0.255 ***	–0.046	0.021	0.031	–0.008
Abnormal Selling, General, and Administrative Margin (SGA Margin)	0.334 ***	–0.531 ***		0.271 ***	0.042	–0.024	–0.045	0.086 *
Market Share	0.115 **	–0.051	0.125 ***		0.485 ***	–0.349 ***	0.326 ***	0.234 ***
Herfindahl Index	0.031	0.009	0.003	0.631 ***		–0.579 ***	0.244 ***	–0.045
# of Firms in Industry	–0.004	0.030	–0.019	–0.795 ***	–0.806 ***		–0.299 ***	–0.044
Acquisition Indicator Variable	0.001	0.043	–0.082 *	0.392 ***	0.322 ***	–0.340 ***		0.226 ***
Market Value of Equity	0.105 **	–0.013	0.048	0.479 ***	–0.023	–0.031	0.222 ***	

Variable Definitions (Calculations using Compustat data items in brackets):

Abnormal Return on Sales	Return on Sales [ebit/revt] adjusted by Return on Sales from a 4-digit NAICS industry [naics] peer matched on the average standardized log of market value of equity, Gross Margin, and Selling, General, and Administrative Margin for the 4 years prior to the disclosure year.
Abnormal Gross Margin	Gross Margin [1 – cogs/revt] adjusted by Gross Margin from a 4-digit NAICS industry [naics] peer matched on the average standardized log of market value of equity, Gross Margin, and Selling, General, and Administrative Margin for the 4 years prior to the disclosure year.
Abnormal Selling, General, and Administrative Margin	Selling, General, and Administrative (SGA) Margin [(ebit + cogs)/revt] adjusted by SGA Margin from a 4-digit NAICS industry [naics] peer matched on average standardized log of market value of equity, Gross Margin, and SGA Margin for the 4 years prior to the disclosure year.
Market Value	The natural log of market value [mvalt] at the end of the fiscal period.

Table 3.3 (Continued)

Variable Definitions (Calculations using Compustat data items in brackets) (Continued):	
Herfindahl Concentration Index	Market Concentration using a Herfindahl index by 4-digit NAICS industry [naics] as measured by: $\sum_{i=1}^{N_{j,t}} \left(Mktshr_{i,t}\right)^2$ where $Mktshr_{i,t}$ is Market Share, defined above, and $N_{j,t}$ is the total number of firms in industry j at time t reported by Compustat that have revenue [revt] greater than 0.
Number of Firms in NAICS4 Industry	Number of Firms in the 4-digit NAICS industry [naics] assigned by firm-year as measured by $N_{j,t}$ above.
Acquisition Indicator Variable	Acquisition indicator variable set to 1 if acquisition expense [aqc] does not equal 0 by firm-year.
Market Share	Firm revenue [revt] divided by 4-digit NAICS [naics] industry revenue by firm-year.
***, **, *, ‡ indicate statistical significance at $p<0.001$, $p<0.01$, $p<0.05$, and $p<0.10$ levels, respectively (2-tailed tests)	

Abnormal ROS is positively correlated with both GM and SGA Margin ($p<0.001$, $p<0.01$). Abnormal GM and SGA Margin are negatively correlated ($p<0.001$), indicating a tradeoff between GM and SGA Margin efficiencies.

Control Variables

Four control variables are included to account for factors that influence abnormal performance that are unrelated to the disclosed customer retention strategy: market share, market concentration, the number of firms within the firm's industry, and acquisition activity.[38] Recent literature has used market share ($Mktshr_{i,t-1}$) as a proxy for a barrier to entry, finding a positive association with abnormal performance (Cheng, 2005). Alternatively, it is possible that firms may pursue a low-price strategy to acquire and maintain market share, leading to a negative association between market share and abnormal performance (Brewer, Garrison, & Noreen, 2007). This paper expects market share, as a proxy for a BTE, to be positively associated with abnormal performance.

Industry concentration ($Herf_{i,t-1}$) and the number of firms within each firm's industry ($IndustryFirms_{i,t-1}$) provide proxies for rivalry. Industry concentration captures rivalry between large and small firms within a market. Prior literature documents a positive relationship between industry concentration and abnormal performance; indicative of imperfect competition and/or efficiency advantages. The number of firms within an industry captures overall industry rivalry, found to be negatively associated

[38] It is likely that customer retention strategy *is*, in part, related to firm size, market share, market concentration, and acquisition activity. However, the control variables are designed to capture past and present barriers to entry erring on the side of capturing some of the *change* in customer retention strategy effect (biasing against results).

with abnormal performance (Waring, 1996). All industry measures refer to 4-digit NAICS classification.

An indicator variable ($Acq_{i,t}$), set to 1 if a firm reports acquisition expense and 0 otherwise, is included to capture the association between acquisition activity and abnormal performance. There is some evidence that acquisitions result in improved performance (Fowler & Schmidt, 1989) under certain conditions (firms have acquisition experience; target firm does not contest acquisition, etc.). Other evidence suggests that expected performance (measured by market reaction) declines with acquisition (Agrawal, Jaffe, & Mandelker, 1992). Therefore, the coefficient carries no directional prediction.

Table 3.3 Panel A reports descriptive statistics for the control variables. Variation in market share between verifiable detail subsamples provides confidence that results are not driven by factors associated with market power. The verifiable detail subsamples for change firms and ongoing firms have the largest (8.6%) and smallest (4.5%) market shares out of all four subsamples. Yet both verifiable detail subsamples have greater increases in performance than the nonverifiable detail subsamples. This implies that market share does not drive results. Both measures of market concentration are similar for the change firm subsamples. This provides confidence that differences in market concentration do not explain the difference in performance trends between verifiable and nonverifiable detail change firms.

Table 3.3 Panel B provides average control variable measures for each year beginning 4 years prior, through 4 years subsequent to the disclosure year. Market share, the number of firms per industry, and acquisition activity, do not appear to exhibit any

consistent pattern for any of the subsamples over the sample period. Market concentration (as measured by the Herfindahl index) monotonically decreases for all of the subsamples with the exception of the nonverifiable detail ongoing firm subsample. This is indicative of a steadily increasing competitive environment over time.

Table 3.3 Panel C reports the Pearson and Spearman correlations among variables. Market share is positively correlated with abnormal ROS and SGA Margin, consistent with size-related efficiencies (Cheng, 2005; Waring, 1996). Market share is negatively correlated with abnormal GM, consistent with the use of prices (thinning GM) to maintain market share (Brewer et al., 2007). Neither measure of industry concentration (Herfindahl and number of firms) is correlated with any of the abnormal performance measures, likely because it is calculated using industry peers as a benchmark. Market value of equity is correlated with abnormal ROS and SGA Margin. However, in untabulated analysis, market value is uncorrelated with abnormal ROS and SGA Margin *except* when using observations from the period *subsequent* to disclosure for firms that provide verifiable detail ($p<0.001$). This is consistent with an increase in expected performance associated with the credible disclosure of customer retention strategy relative to matched industry peers.

Research Design

The association between nonfinancial disclosure and change in persistence of positive abnormal performance uses regression analysis similar to that used by Harris (1998). BTE theory suggests that a cost advantage deters potential competitors from

entering the product-market (Stigler, 1964), increasing the persistence of *positive* abnormal performance. However, potential competitors do not have the same incentive to enter the market if the incumbent is incurring *negative* abnormal performance.[39] This nonlinearity requires a regression that separates negative and positive persistence.

$$ABPerf_{i,t} = \varphi_{1,i} NEG_{i,t-1} + \varphi_{2,i} POS_{i,t-1} + \varphi_3 NEG_{i,t-1} * ABPerf_{i,t-1} + \varphi_4 POS_{i,t-1} * ABPerf_{i,t-1} + \sum_{k=9}^{12} \varphi_k Controls_{i,t-1} + \varepsilon_{i,t} \quad (3.1)$$

$ABPerf_{i,t}$ measures abnormal performance for firm i at time t using one of the three performance measures (ROS, GM, and ROSGA) discussed in the previous subsection. Prior period *negative* abnormal performance is captured by the interaction between abnormal performance and an indicator variable ($NEG_{i,t-1}$) equal to 1 if the abnormal performance for firm i at time t-1 is less than zero and equal to 0 otherwise. Similarly, prior period *positive* abnormal performance is captured by the interaction between abnormal performance and indicator variable ($POS_{i,t-1}$) equal to 1 if abnormal performance is greater than or equal to zero and 0 otherwise. Coefficients φ_3 and φ_4 capture negative and positive abnormal performance *persistence* and are expected to be between 0 and 1 (Harris, 1998). The coefficients ($\varphi_{1,i}$ and $\varphi_{2,i}$) on the indicator variables allow the intercepts to vary by each firm i to capture firm-specific heterogeneity in

[39] It is possible that the same actions used to create a BTE cost advantage change the rate at which performance changes (perhaps reducing the persistence of negative performance) than without the change in strategy. In this case, the investment associated with the change in strategy must be more efficient (increase performance at a quicker rate) than existing investments. However, customer retention theory does not specify the effect of customer retention investment on the time it takes to achieve positive abnormal performance.

negative and positive abnormal performance.[40]

A disclosure indicator variable ($DISC_{i,t}$) is added to identify changes in persistence of abnormal performance subsequent to disclosure. $DISC_{i,t}$ is equal to 0 for all periods through the disclosure year and equal to 1 for subsequent periods:

$$\begin{aligned} ABPerf_{i,t} &= \varphi_{1,i} NEG_{i,t-1} + \varphi_{2,i} POS_{i,t-1} + \varphi_3 NEG_{i,t-1} * ABPerf_{i,t-1} + \varphi_4 POS_{i,t-1} * ABPerf_{i,t-1} \\ &+ \varphi_5 DISC_{i,t-1} * NEG_{i,t-1} + \varphi_6 DISC_{i,t-1} * POS_{i,t-1} + \varphi_7 DISC_{i,t-1} * NEG_{i,t-1} * ABPerf_{i,t-1} \\ &+ \varphi_8 DISC_{i,t-1} * POS_{i,t-1} * ABPerf_{i,t-1} + \sum_{k=9}^{12} \varphi_k Controls_{i,t-1} + \varepsilon_{i,t} \end{aligned} \quad (3.2)$$

Coefficients (φ_7 and φ_8) on the interactions between abnormal performance ($NEG_{i,t}$*$ABPerf_{i,t}$ and $POS_{i,t}$*$ABPerf_{i,t}$) and the disclosure indicator variable ($DISC_{i,t}$) estimate the change in persistence subsequent to the disclosure year. The persistence of negative abnormal performance is not expected to change because competitors do not have an incentive to pursue negative abnormal performance (φ_7=0). In contrast, a BTE is expected to increase the persistence of positive abnormal performance (φ_8>0).

Hypotheses 3.1 and 3.2 compare the change in persistence of positive abnormal performance for firms that provide verifiable detail with that of firms that do not ($\varphi_{8,verifiable\ detail} > \varphi_{8,nonverifiable\ detail}$) for change and ongoing firms, respectively.[41] Hypothesis 3.3 makes a similar comparison between the change firms and ongoing firms which provide verifiable detail ($\varphi_{8,verifiable\ change\ firms} > \varphi_{8,verifiable\ ongoing\ firms}$).

[40] The negative and positive indicator variable intercepts are interacted with firm indicator variables to capture firm-specific differences in negative and positive abnormal performance.

[41] The hypothesis tests are performed by using a stacked regression that combines subsamples, using verifiable detail indicator variable interactions to identify differences between the subsamples. For exposition, the subsample regressions are reported separately.

The coefficients (φ_5 and φ_6) on the interaction between the negative and positive performance indicator variables and the disclosure indicator variable allow the negative and positive intercepts to vary subsequent to disclosure. φ_5 and φ_6 cannot be interpreted as changes in the level of abnormal performance associated with disclosure without accounting for changes in persistence (φ_7 and φ_8). Section 3.5 provides additional analysis to compare changes in the level of abnormal performance between subsamples.

Each regression uses panel data as described in Table 3.1. There is likely auto-correlation within each panel that inflates standard errors.[42] The parameter estimates are calculated using generalized least squares regression using the Prais-Winsten estimator (1954) to correct for panel-specific auto-regression (Vogelsang, 1998). Firm indicator variables are also included to account for fixed effects (Petersen, 2009).[43]

Primary Results

The empirical results identify a difference in the change in persistence of positive abnormal performance associated with the disclosure of customer retention strategy between firms that provide verifiable detail and firms that do not. Table 3.4 Panel A provides a summary of the regression results testing hypothesis 3.1, using change firms. Panel B provides results for hypothesis 3.2, using ongoing firms. Finally, Panel C provides results for hypothesis 3.3, comparing change and ongoing firms that provide verifiable detail.

Each trio of columns reports results using one of the three abnormal performance

[42] The matched-pair design using firms within the same industry removes any cross-sectional correlation.
[43] The firm indicator variables are interacted with $NEG_{i,t-1}$ and $POS_{i,t-1}$ to capture firm-specific differences in negative and positive intercepts.

Table 3.4

Persistence of Positive Abnormal Performance

Panel A: Regression Results for Firms that Disclose a *Change* in Customer Retention Strategy

$$ABPerf_{i,t} = \varphi_{1,i} NEG_{i,t-1} + \varphi_{2,i} POS_{i,t-1} + \varphi_3 NEG_{i,t-1} * ABPerf_{i,t-1} + \varphi_4 POS_{i,t-1} * ABPerf_{i,t-1} + \varphi_5 DISC_{i,t-1} * NEG_{i,t-1} + \varphi_6 DISC_{i,t-1} * POS_{i,t-1} + \varphi_7 DISC_{i,t-1} * NEG_{i,t-1} * ABPerf_{i,t-1} + \varphi_8 DISC_{i,t-1} * POS_{i,t-1} * ABPerf_{i,t-1} + \sum_{k=9}^{12} \varphi_k Controls_{i,t-1} + \varepsilon_{i,t} \quad (3.2)$$

				DV = Abnormal ROS			DV = Abnormal GM			DV = Abnormal SGA Margin		
Variable	Para meter	Exp. Sign	Exp. Sign of Diff.	Verif Chg	Non-verif.	Sig of Diff	Verif Chg	Non-verif.	Sig of Diff	Verif Chg	Non-verif.	Sig of Diff
		(Cred/ Non)	Cred – Non	Parameter (*t*-stat)	Parameter (*t*-stat)	(*t*-stat)	Parameter (*t*-stat)	Parameter (*t*-stat)	(*t*-stat)	Parameter (*t*-stat)	Parameter (*t*-stat)	(*t*-stat)
$NEG_{i,t-1}$[1]	($\varphi_{1,i}$)	(– / –)	(0)	–0.025	–0.061		–0.010	–0.060		–0.024	–0.067	
				(–2.19)*	(–5.84)***	(–0.59)	(–1.20)	(–3.69)**	(0.62)	(–2.03)‡	(–2.78)*	(3.63)***
$POS_{i,t-1}$[1]	($\varphi_{2,i}$)	(+ / +)	(0)	0.066	0.029		0.050	0.076		0.050	0.003	
				(7.92)***	(2.91)**	(–0.27)	(5.72)***	(4.75)***	(0.23)	(4.39)***	(0.88)	(3.52)***
$NEG_{i,t-1}$	(φ_3)	(+ / +)	(0)	0.209	0.510		0.177	0.281		0.337	0.483	
$*ABPerf_{i,t-1}$				(2.14)*	(2.15)*	(–1.11)	(1.29)	(1.83)‡	(0.21)	(2.65)**	(3.64)***	(–0.84)
$POS_{i,t-1}$	(φ_4)	(+ / +)	(0)	0.037	0.296		0.475	0.355		0.295	0.194	
$*ABPerf_{i,t-1}$				(0.19)	(2.78)**	(–1.18)	(3.41)***	(2.48)*	(1.33)	(2.29)*	(1.42)	(0.28)
$DISC_{i,t-1} *NEG_{i,t-1}$	(φ_5)	(? / 0)	(?)	–0.019	–0.015		0.005	0.019		–0.007	0.005	
				(–1.79)‡	(–0.75)	(0.01)	(0.57)	(1.62)	(–1.52)	(–0.63)	(0.58)	(–1.24)
$DISC_{i,t-1} *POS_{i,t-1}$	(φ_6)	(? / 0)	(?)	–0.006	0.008		0.007	0.007		–0.025	0.013	
				(–0.67)	(0.86)	(–1.33)	(0.44)	(0.83)	(0.73)	(–3.46)***	(1.74)‡	(–3.25)***
$DISC_{i,t-1} *NEG_{i,t-1}$	(φ_7)	(? / 0)	(?)	0.080	–0.401		0.110	–0.000		–0.062	–0.064	
$*ABPerf_{i,t-1}$				(0.39)	(–1.67)‡	(2.02)*	(0.59)	(–0.01)	(–0.19)	(–0.44)	(–0.67)	(0.04)
$DISC_{i,t-1} *POS_{i,t-1}$	(φ_8)	(+ / 0)	(+)	0.331	0.016		–0.156	0.040		0.486	–0.103	
$*ABPerf_{i,t-1}$				(1.44)	(0.12)	(1.38)	(–0.44)	(0.50)	(–1.01)	(3.49)***	(–1.39)	(3.98)***
$Mktshr_{I,t-1}$	(φ_9)	(+ / +)	(0)	–0.033	0.028		–0.050	–0.035		–0.067	0.232	
				(–0.52)	(2.25)*	(–0.81)	(–0.26)	(–0.76)	(–0.15)	(–0.86)	(4.76)***	(–4.00)***
$Herf_{i,t-1}$	(φ_{10})	(+ / +)	(0)	–0.136	0.095		–0.086	–0.067		–0.091	0.354	
				(–3.09)**	(4.55)***	(–4.52)***	(–0.75)	(–1.01)	(–0.24)	(–1.84)‡	(6.26)***	(–7.46)***
$Industry\ Firms_{i,t-1}$	(φ_{11})	(– / –)	(0)	0.000	0.000		–0.000	–0.000		0.000	–0.000	
				(1.49)	(0.86)	(–0.06)	(–0.42)	(–0.28)	(–0.19)	(3.79)***	(–2.52)*	(0.29)
$Acq_{i,t-1}$	(φ_{12})	(? / ?)	(?)	–0.011	–0.036		0.001	0.004		–0.008	–0.003	
				(–1.92)‡	(–3.61)***	(2.34)*	(0.15)	(0.53)	(0.19)	(–1.49)	(–0.40)	(–0.44)
Adj. *R*-Sq.				*0.823*	*0.860*		*0.763*	*0.923*		*0.862*	*0.912*	

Table 3.4 (Continued)

Panel B: Regression Results for Firms that Disclose an *Ongoing* Customer Retention Strategy

$$ABPerf_{i,t} = \varphi_{1,i} NEG_{i,t-1} + \varphi_{2,i} POS_{i,t-1} + \varphi_3 NEG_{i,t-1} * ABPerf_{i,t-1} + \varphi_4 POS_{i,t-1} * ABPerf_{i,t-1} + \varphi_5 DISC_{i,t-1} * NEG_{i,t-1} + \varphi_6 DISC_{i,t-1} * POS_{i,t-1} + \varphi_7 DISC_{i,t-1} * NEG_{i,t-1} * ABPerf_{i,t-1} + \varphi_8 DISC_{i,t-1} * POS_{i,t-1} * ABPerf_{i,t-1} + \sum_{k=9}^{12} \varphi_k Controls_{i,t-1} + \varepsilon_{i,t} \quad (3.2)$$

Variable	Parameter	Exp. Sign	Exp. Sign of Diff.	DV = Abnormal ROS			DV = Abnormal GM			DV = Abnormal SGA Margin		
				Verif Ong	Non-verif.	Sig of Diff	Verif Ong	Non-verif.	Sig of Diff	Verif Ong	Non-verif.	Sig of Diff
		(Cred/ Non)	Cred – Non	Parameter (*t*-stat)	Parameter (*t*-stat)	(*t*-stat)	Parameter (*t*-stat)	Parameter (*t*-stat)	(*t*-stat)	Parameter (*t*-stat)	Parameter (*t*-stat)	(*t*-stat)
$NEG_{i,t-1}$[1]	($\varphi_{1,i}$)	(– / –)	(0)	–0.004 (–0.15)	–0.040 (–3.92)***	(–2.60)**	–0.064 (–8.79)***	–0.058 (–4.13)***	(–2.00)*	–0.018 (–0.74)	–0.023 (–0.74)	(0.86)
$POS_{i,t-1}$[1]	($\varphi_{2,I}$)	(+ / +)	(0)	0.093 (2.69)*	0.052 (5.86)***	(–2.78)**	–0.011 (–0.93)	0.071 (3.32)**	(–2.01)*	0.057 (7.05)***	0.080 (3.02)**	(0.85)
$NEG_{i,t-1}$ *$ABPerf_{i,t-1}$	(φ_3)	(+ / +)	(0)	0.393 (3.45)***	0.300 (2.55)*	(0.76)	0.201 (1.81)*	0.028 (0.54)	(0.99)	0.121 (1.28)	0.202 (1.44)	(–0.50)
$POS_{i,t-1}$ *$ABPerf_{i,t-1}$	(φ_4)	(+ / +)	(0)	0.038 (0.23)	0.298 (5.42)***	(–0.81)	–0.130 (–0.91)	0.217 (1.83)‡	(–2.09)*	0.085 (0.73)	0.369 (3.30)***	(–1.83)‡
$DISC_{i,t-1}$ *$NEG_{i,t-1}$	(φ_5)	(? / 0)	(?)	–0.004 (–0.25)	0.030 (2.48)*	(–2.87)**	0.029 (5.44)***	–0.001 (–0.23)	(3.58)***	0.013 (1.04)	0.002 (0.16)	(0.82)
$DISC_{i,t-1}$ *$POS_{i,t-1}$	(φ_6)	(? / 0)	(?)	0.024 (1.51)	0.003 (0.37)	(1.56)	0.032 (2.78)**	0.009 (1.32)	(1.89)‡	–0.011 (–2.19)*	–0.013 (–2.47)*	(0.30)
$DISC_{i,t-1}$*$NEG_{i,t-1}$ *$ABPerf_{i,t-1}$	(φ_7)	(? / 0)	(?)	–0.005 (–0.02)	0.637 (2.63)**	(–3.00)**	0.663 (7.28)***	0.209 (2.20)*	(3.41)***	0.076 (0.24)	0.214 (1.33)	(–0.44)
$DISC_{i,t-1}$*$POS_{i,t-1}$ *$ABPerf_{i,t-1}$	(φ_8)	(+ / 0)	(+)	–0.399 (–1.64)	–0.387 (–2.55)*	(–0.36)	–0.367 (–1.39)	–0.133 (–1.62)	(–0.91)	0.541 (4.14)***	0.058 (0.95)	(3.11)**
$Mktshr_{I,t-1}$	(φ_9)	(+ / +)	(0)	0.077 (1.05)	–0.118 (–1.71)‡	(2.31)*	0.165 (2.21)*	–0.181 (–3.26)***	(3.62)***	–0.021 (–1.02)	–0.317 (–3.12)**	(2.75)**
$Herf_{i,t-1}$	(φ_{10})	(+ / +)	(0)	–0.264 (–3.40)***	–0.025 (–0.33)	(–2.30)*	0.052 (0.83)	–0.171 (–3.11)**	(3.13)**	–0.061 (–1.16)	–0.183 (–2.46)*	(1.49)
$Industry\ Firms_{i,t-1}$	(φ_{11})	(– / –)	(0)	0.000 (1.86)‡	0.000 (0.60)	(2.56)**	0.000 (1.07)	0.000 (2.38)*	(0.26)	–0.000 (–1.65)‡	–0.000 (–1.03)	(–1.08)
$Acq_{i,t-1}$	(φ_{12})	(? / ?)	(?)	–0.019 (–1.69)‡	–0.013 (–1.50)	(–0.58)	–0.007 (–1.48)	–0.016 (–2.50)*	(1.44)	0.001 (0.26)	0.018 (1.82)‡	(–1.48)
Adj. *R*-Sq.				*0.810*	*0.758*		*0.887*	*0.927*		*0.864*	*0.936*	

Table 3.4 (Continued)

Panel C: Comparison of Firms that Disclose Verifiable *Change* versus Verifiable *Ongoing* Customer Retention Strategies

$$ABPerf_{i,t} = \varphi_{1,i} NEG_{i,t-1} + \varphi_{2,i} POS_{i,t-1} + \varphi_3 NEG_{i,t-1} * ABPerf_{i,t-1} + \varphi_4 POS_{i,t-1} * ABPerf_{i,t-1} + \varphi_5 DISC_{i,t-1} * NEG_{i,t-1} + \varphi_6 DISC_{i,t-1} * POS_{i,t-1} + \varphi_7 DISC_{i,t-1} * NEG_{i,t-1} * ABPerf_{i,t-1} + \varphi_8 DISC_{i,t-1} * POS_{i,t-1} * ABPerf_{i,t-1} + \sum_{k=9}^{12} \varphi_k Controls_{i,t-1} + \varepsilon_{i,t} \quad (3.2)$$

Variable	Parameter	Exp. Sign	Exp. Sign of Diff.	DV = Abnormal ROS			DV = Abnormal GM			DV = Abnormal SGA Margin		
				Verif Chg	Verif Ong	Sig of Diff	Verif Chg	Verif Ong	Sig of Diff	Verif Chg	Verif Ong	Sig of Diff
		(Cred/ Less)	Cred – Less	Parameter (*t*-stat)	Parameter (*t*-stat)	(*t*-stat)	Parameter (*t*-stat)	Parameter (*t*-stat)	(*t*-stat)	Parameter (*t*-stat)	Parameter (*t*-stat)	(*t*-stat)
$NEG_{i,t-1}$[1]	($\varphi_{1,i}$)	(– / –)	(0)	–0.025	–0.004		–0.010	–0.064		–0.024	–0.018	
				(–2.19)*	(–0.15)	(–0.59)	(–1.20)	(–8.79)***	(0.50)	(–2.03)‡	(–0.74)	(3.63)***
$POS_{i,t-1}$[1]	($\varphi_{2,I}$)	(+ / +)	(0)	0.066	0.093		0.050	–0.011		0.050	0.057	
				(7.92)***	(2.69)*	(–0.27)	(5.72)***	(–0.93)	(–0.30)	(4.39)***	(7.05)***	(3.52)***
$NEG_{i,t-1}$	(φ_3)	(+ / +)	(0)	0.209	0.393		0.177	0.201		0.337	0.121	
$*ABPerf_{i,t-1}$				(2.14)*	(3.45)	(–1.92)‡	(1.29)	(1.81)*	(0.80)	(2.65)**	(1.28)	(1.47)
$POS_{i,t-1} *ABPerf_{i,t-1}$	(φ_4)	(+ / +)	(0)	0.037	0.038		0.475	–0.130		0.295	0.085	
				(0.19)	(0.23)	(–0.27)	(3.41)***	(–0.91)	(3.53)***	(2.29)*	(0.73)	(0.92)
$DISC_{i,t-1} *NEG_{i,t-1}$	(φ_5)	(? / ?)	(?)	–0.019	–0.004		0.005	0.029		–0.007	0.013	
				(–1.79)‡	(–0.25)	(–0.66)	(0.57)	(5.44)***	(–3.45)***	(–0.63)	(1.04)	(–1.79)‡
$DISC_{i,t-1} *POS_{i,t-1}$	(φ_6)	(? / ?)	(?)	–0.006	0.024		0.007	0.032		–0.025	–0.011	
				(–0.67)	(1.51)	(–2.11)*	(0.44)	(2.78)**	(–0.65)	(–3.46)***	(–2.19)*	(–2.65)**
$DISC_{i,t-1} *NEG_{i,t-1}$	(φ_7)	(? / ?)	(?)	0.080	–0.005		0.110	0.663		–0.062	0.076	
$*ABPerf_{i,t-1}$				(0.39)	(–0.02)	(0.64)	(0.59)	(7.28)***	(–3.11)**	(–0.44)	(0.24)	(–0.59)
$DISC_{i,t-1} *POS_{i,t-1}$	(φ_8)	(+ / +)	(+)	0.331	–0.399		–0.156	–0.367		0.486	0.541	
$*ABPerf_{i,t-1}$				(1.44)	(–1.64)	(2.76)**	(–0.44)	(–1.39)	(0.13)	(3.49)***	(4.14)***	(0.07)
$Mktshr_{I,t-1}$	(φ_9)	(+ / +)	(0)	–0.033	0.077		–0.050	0.165		–0.067	–0.021	
				(–0.52)	(1.05)	(–1.03)	(–0.26)	(2.21)*	(–1.09)	(–0.86)	(–1.02)	(–0.83)
$Herf_{i,t-1}$	(φ_{10})	(+ / +)	(0)	–0.136	–0.264		–0.086	0.052		–0.091	–0.061	
				(–3.09)**	(–3.40)***	(1.74)‡	(–0.75)	(0.83)	(–1.19)	(–1.84)‡	(–1.16)	(–0.53)
$Industry\ Firms_{i,t-1}$	(φ_{11})	(– / –)	(0)	0.000	0.000		–0.000	0.000		0.000	–0.000	
				(1.49)	(1.86)‡	(–1.71)‡	(–0.42)	(1.07)	(–1.81)‡	(3.79)***	(–1.65)‡	(–0.83)
$Acq_{i,t-1}$	(φ_{12})	(? / ?)	(?)	–0.011	–0.019		0.001	–0.007		–0.008	0.001	
				(–1.92)‡	(–1.69)‡	(0.74)	(0.15)	(–1.48)	(1.61)	(–1.49)	(0.26)	(–1.07)
Adj. *R*-Sq.				*0.823*	*0.810*		*0.763*	*0.887*		*0.862*	*0.864*	

Table 3.4 (Continued)

All variables are defined in Table 3.3.
All estimates use Paris-Winston regressions that correct standard errors for correlated panels and panel-specific auto-correlation.
***, **, *, ‡ indicate statistical significance at $p<0.001$, $p<0.01$, $p<0.05$, and $p<0.10$ levels, respectively (2-tailed tests)
Verifiable Detail and Nonverifiable Detail Change subsample sizes (*N*) are 141 and 185, respectively
Verifiable Detail and Nonverifiable Detail Ongoing subsample sizes (*N*) are 118 and 321, respectively
[1] Reported values for coefficients $\varphi_{1,i}$ and $\varphi_{2,i}$ are mean values of all estimated coefficients. Significance for mean values is calculated using Fama-MacBeth *t*-statistics.

measures: ROS, GM, and SGA Margin. The combination of results provides insight into the sources of cost advantage that contribute to changes in positive abnormal persistence. As described previously, GM captures customer switching costs while SGA Margin captures both customer switching costs *and* transaction costs. Similarly, SGA Margin does *not* capture production/purchasing efficiencies while GM does. ROS captures the combined effects of all cost advantages on firm performance. Section 3.5 provides additional analysis to identify changes in the levels of performance within and between subsamples. Thus, no discussion regarding coefficients $\varphi_{1,i}$, $\varphi_{2,i}$, φ_5, and φ_6 is included in this section.

Results Using Firms That Disclose a Change in Customer Retention Strategy

Table 3.4 Panel A provides regression results comparing firms that provide verifiable detail relating to a *change* in customer retention strategy with change firms that do *not*. Each trio of columns reports: 1) the regression results for change firms that provide verifiable detail, 2) results for firms that do not provide verifiable detail, and 3) the significance of the difference between the parameter estimates from the two subsamples.

Parameter φ_8 captures changes in positive abnormal persistence subsequent to disclosure. The results using abnormal ROS and GM (first two sets of columns) do not reveal any significant changes in positive abnormal persistence nor any differences associated with the level of verifiable detail. However, results using SGA Margin (third set of columns) reveals a significant increase in the persistence of positive abnormal

performance (φ_8=0.331 p<0.001) for firms that provide verifiable detail in their disclosure of a change in strategy. Further supporting hypothesis 3.1, the change in persistence for firms that provide verifiable detail is greater than that of firms that do not (p<0.001). The fact that these results only manifest themselves using SGA Margin is consistent with an increased customer transaction cost advantage as opposed to customer switching costs and/or production/purchasing efficiencies.

The parameter estimates on the control variables differ between subsamples and are not entirely consistent with expectations. For example, the parameter estimate on market share for the subsample of firms that provides verifiable detail indicates that market share is *not* associated with abnormal performance. This implies that, on average, market share is not an indicator of market power leading to abnormal performance. The parameter estimates on the Herfindahl industry concentration index are negative using ROS and SGA Margin. This implies that a high concentration of large (relative to small) firms within a market is *not* associated with imperfect competition and/or efficiency advantages, but is indicative of an environment that deteriorates abnormal performance. Finally, the parameter estimate on the number of firms within each industry is positive for the verifiable detail subsample. This implies that greater numbers of competitors are associated with higher abnormal performance. It is possible that this is representative of a market with many niche product opportunities.

In summary, the results using change firms are consistent with hypothesis 3.1, that verifiable detail is a valid source of credibility for firms that disclose a change in customer retention strategy. Further, the cost advantage associated with the customer

retention disclosure appears to be derived from customer transaction costs as opposed to customer switching costs. Finally, the verifiable detail subsample appears to be comprised on firms that reside in competitive environments where market share does *not* imply market power and industry concentration does *not* enable persistent abnormal profits. It is possible that this environment is conducive for credible disclosure of customer retention strategy because of its unique competitive characteristics.

Results for Firms That Disclose an Ongoing Customer Retention Strategy

Table 3.4 Panel B provides regression results comparing firms that provide verifiable detail relating to an *ongoing* customer retention strategy with firms that do not. The persistence of SGA Margin (third set of columns) increases subsequent to disclosure (φ_8=0.541 p<0.001) for firms that provide verifiable detail. Further, supporting hypothesis 3.2, the change in persistence for ongoing firms that provide verifiable detail is greater than that of firms that do not (p<0.01).

Predisclosure positive abnormal GM persistence (φ_4) is negative, albeit insignificant (p=0.362). This implies that prior to disclosure, firms that disclose an ongoing customer retention strategy with verifiable detail are unable to retain positive abnormal gross margin, perhaps due to the use of low prices to retain customers. Additionally, the persistence of predisclosure positive abnormal SGA Margin (φ_4) for firms that provide verifiable detail is marginally less than that of firms that do not provide it (p<0.10). These results indicate that firms in the verifiable detail subsample may be candidates for persistence improvements relative to firms that do not disclose verifiable

detail.

Similar to analysis using change firms (previous subsection), the parameter estimates on the control variables differ between subsamples and are not completely consistent with expectations. For example, the nonverifiable subsample parameter estimates on market share are negative for all performance measures ($p<0.10$, $p<0.001$, $p<0.01$). This implies that market share does not represent market power. It is possible that high-market share firms in this subsample are pricing aggressively to preserve their share, resulting in poor abnormal performance relative to firms with lower market share. Additionally, the parameter estimates on the Herfindahl industry concentration index are negative ($p<0.001$, $p<0.01$, $p<0.05$) and the parameter estimates on the number of firms within the industry are positive using ROS and GM ($p<0.10$, $p<0.05$). This implies that market concentration is *not* associated with imperfect competition and/or efficiency advantages. It is indicative of an environment where large numbers of unconcentrated competitors lead to positive abnormal performance (perhaps due to niche product opportunities).

In summary, the results using ongoing firms are consistent with hypothesis 3.2, that verifiable detail is a valid source of credibility for firms that disclose an ongoing customer retention strategy. Further, the disclosure itself (disclosure effect) appears to contribute to the effectiveness of the BTE strategy by deterring competitors from entering the market. Finally, the ongoing firm subsamples appear to be comprised of firms that reside in unusual competitive environments where market share does *not* imply market power and interfirm competition does *not* erode abnormal profits. Both ongoing firm

subsamples have a similar competitive environment, yet only the verifiable detail subsample has a positive change in the persistence of abnormal performance. This provides confidence that the environment itself does *not* drive the results supporting hypothesis 3.2.

Results From Comparing Firms That Disclose a Change in Customer Retention Strategy with Those that Disclose an Ongoing Customer Retention Strategy, Both of Which Provide Verifiable Detail

Table 3.4 Panel C provides regression results comparing firms that provide verifiable detail relating to a *change* in customer retention strategy with those that provide verifiable detail relating to an *ongoing* customer retention strategy. As mentioned in the previous two subsections, both verifiable subsamples (*change* and *ongoing* firms) show an increase in the persistence of positive abnormal SGA Margin (φ_8=0.486, 0.541; p<0.001). These increases are not significantly different between the *change* and *ongoing* subsamples (p=0.947), indicating that both disclosures are equally credible with respect to SGA Margin. However, the change in positive abnormal ROS persistence is greater for the *change* firm subsample relative to the *ongoing* firm subsample (p<0.01). This result provides support for hypothesis 3.3, that the credibility of verifiable details associated with a *change* in customer retention strategy is inherently greater than the credibility of verifiable details relating to an *ongoing* customer retention strategy.

As mentioned in the previous subsection, firms in the change and ongoing subsamples fit a similar competitive profile. Specifically, market share is not positively associated with abnormal performance (with the exception of GM in the ongoing firm

subsample, $p<0.05$). The parameter estimates on the Herfindahl industry concentration index are generally negative ($p<0.01$, $p<0.001$, $p<0.10$) and the parameter estimates on the number of firms within the industry are positive for the ongoing firms using ROS ($p<0.10$) and for the change firms using SGA Margin ($p<0.001$). In contrast, the parameter estimate on the number of industry firms for the ongoing firm subsample using SGA margin is negative ($p<0.10$). This implies that market concentration does *not* lead to imperfect competition and/or efficiency advantages and greater numbers of competitors do *not* appear to erode abnormal performance.

In summary, the results from comparing change and ongoing firms that provide verifiable detail are consistent with hypothesis 3.3, that change firms that provide verifiable detail are associated with greater changes in positive abnormal persistence than ongoing firms that provide verifiable detail.

Additional Analysis

Robustness Tests

This paper performs two robustness tests to validate the primary results. First, it varies the pre- and postdisclosure time horizons to mitigate concerns about confounding effects within the sample period and to provide adequate time to capture postdisclosure performance trends. Second, it uses an alternative benchmark, 4-digit NAICS mean industry performance, for calculating abnormal performance.

Alternative Timing

The primary results use 4 years of predisclosure and 4 years of postdisclosure data. As discussed in section 3.3, this is done to provide an adequate number of firm-years to establish pre- and postdisclosure performance trends, yet limits the potential influence of factors unrelated to customer retention strategy. In this section, three variations in timing are used to establish the robustness of the primary results. First, the pre- and postdisclosure periods are reduced to exactly 2 years (–2/+2 window). This is done to isolate immediate pre- and postdisclosure performance. Additionally, it eliminates any incremental weight placed on firms that have a full complement of firm-year observations relative to those that do not. Second, the postdisclosure period is increased to 6 years (–4/+6 window). This is done to capture performance effects that take longer to materialize. The third variation uses all, up to 15 firm-years, available data (all firm-years) to capture long-term changes.

Results (untabulated) support hypothesis 3.1 across all three timing iterations. Specifically, similar to the primary results discussed in section 3.4, the increase in persistence of positive abnormal SGA Margin for firms that provide verifiable detail exceeds that of firms that do not. In addition, the ROS performance measure *also* provides support for hypothesis 3.1. The change in positive abnormal ROS persistence for firms that provide verifiable detail exceeds that of firms that do *not* using the –4/+6 window and the all firm-years timing variations.

Hypothesis 3.2 is supported by results using the –2/+2 window and –4/+6 window

timing iterations. The results are similar to the primary results described in section 3.4 (higher positive SGA Margin persistence for firms that provide verifiable detail). However, results using the all firm-years timing variation do *not* support hypothesis 3.2. It is possible that factors unrelated to customer retention disclosure confound the ongoing firm results as the sample window is expanded.

Finally, all but the –2/+2 window timing variation provide results that support hypothesis 3.3 (the change in positive abnormal persistence associated with change firms exceeds that of ongoing firms given disclosures that provide verifiable detail). This implies that the change in persistence for ongoing firms (disclosure effect) is concentrated in the years immediately surrounding the disclosure.

Alternative Benchmark – Industry Average Performance

As discussed in section 3.3, the primary results measure abnormal performance using a matched-pair design. This section evaluates results using 4-digit NAICS industry mean-adjusted abnormal performance measures. An additional variable, the natural log of market value of equity, is added as a control variable to equation 3.2 to account for systematic size-related performance trends.[44]

Table 3.5 provides descriptive statistics and bivariate correlations. Panel A reveals that disclosing firms tend to have negative industry-adjusted ROS, decomposed into positive industry-adjusted GM more than offset by negative industry-adjusted SGA Margin. Panel B reveals that the nonverifiable change firm subsample ROS decreases

[44] The matched-pair design did not need this control variable because it controlled for size-related performance trends by calculating abnormal performance using firms matched on firm size.

Table 3.5

Descriptive Statistics for Performance Variables Using 4-digit NAICS Mean as a Benchmark

Panel A – Descriptive Statistics

Variable	Samples	# Firms	Mean	Median	1st Quartile	3rd Quartile	Std Deviation
Performance Variables							
Abnormal Return on Sales	Total Sample	98	(2.0%)	(1.2%)	(4.9%)	2.2%	12 points
	Subsamples:						
	Verifiable Change	18	(1.6%)	0.4%	(1.9%)	2.5%	13 points
	Nonverifiable Change	23	0.5%	(0.8%)	(4.5%)	5.9%	7 points
	Verifiable Ongoing	15	(1.4%)	(3.2%)	(5.6%)	(1.0%)	18 points
	Nonverifiable Ongoing	42	(3.7%)	(1.8%)	(7.8%)	0.9%	11 points
Abnormal Gross Margin	Total Sample	98	4.1%	1.6%	(4.4%)	10.0%	16 points
	Subsamples:						
	Verifiable Change	18	2.6%	3.4%	(2.5%)	7.1%	15 points
	Nonverifiable Change	23	4.1%	2.4%	(1.9%)	8.4%	9 points
	Verifiable Ongoing	15	6.5%	(2.1%)	(4.8%)	10.8%	25 points
	Nonverifiable Ongoing	42	3.8%	1.9%	(7.3%)	10.7%	16 points
Abnormal Selling, General, and Administrative Margin	Total Sample	98	(6.1%)	(2.6%)	(11.1%)	1.9%	13 points
	Subsamples:						
	Verifiable Change	18	(4.2%)	(2.1%)	(10.1%)	3.3%	13 points
	Nonverifiable Change	23	(3.6%)	(2.0%)	(8.8%)	1.1%	7 points
	Verifiable Ongoing	15	(7.9%)	(2.6%)	(11.1%)	2.4%	20 points
	Nonverifiable Ongoing	42	(7.6%)	(5.0%)	(16.4%)	1.9%	13 points

Table 3.5 (Continued)

Panel B – Mean Values by Year										
Variable		4 yrs prior	3 yrs prior	2 yrs prior	1 yr prior	Disclosure Year	1 yr after	2 yrs after	3 yrs after	4 yrs after
Performance Variables										
# of Firms	Total Sample	81	91	98	98	98	98	98	81	66
	Subsamples:									
	Verifiable Change	14	15	18	18	18	18	18	15	14
	Nonverifiable Change	19	20	23	23	23	23	23	22	17
	Verifiable Ongoing	13	15	15	15	15	15	15	12	10
	Nonverifiable Ongoing	35	41	42	42	42	42	42	32	18
Mean Abnormal Return on Sales	Total Sample	0.8%	(1.9%)	(1.7%)	(0.1%)	(1.1%)	(2.6%)‡	(3.8%)*	(2.5%)‡	(3.6%)‡
	Subsamples:									
	Verifiable Change	3.9%*	(0.8%)	(1.6%)	(1.6%)	(2.0%)	(0.7%)	(1.3%)	(2.5%)	(4.0%)
	Nonverifiable Change	3.9%*	4.4%*	1.3%	1.1%	1.0%	(1.8%)	(1.2%)	(1.3%)	(4.3%)
	Verifiable Ongoing	3.8%	(10.1%)	(2.9%)	(0.8%)	(0.5%)	(0.0%)	0.1%	0.7%	2.1%
	Nonverifiable Ongoing	(3.2%)‡	(2.4%)	(3.0%)	0.2%	(2.1%)	(4.7%)*	(7.7%)*	(4.6%)*	(5.3%)‡
Mean Abnormal Gross Margin	Total Sample	3.8%‡	4.4%*	4.2%*	4.8%**	3.8%*	4.0%*	4.0%*	3.9%*	2.8%
	Subsamples:									
	Verifiable Change	7.2%‡	5.5%	2.6%	2.1%	2.4%	3.2%	2.7%	0.2%	(2.3%)
	Nonverifiable Change	2.4%	4.0%‡	1.4%	2.9%	3.7%	4.5%*	5.6%*	6.9%*	4.1%
	Verifiable Ongoing	9.6%	6.0%	7.1%	6.8%	6.5%	6.6%	5.7%	6.2%	10.0%
	Nonverifiable Ongoing	0.9%	3.6%	5.3%‡	6.4%*	3.4%	3.1%	3.2%	2.8%	1.8%
Abnormal Selling, General, and Administrative Margin	Total Sample	(2.9%)‡	(6.3%)*	(5.9%)***	(4.9%)**	(4.9%)***	(6.5%)***	(7.8%)***	(6.4%)***	(6.4%)***
	Subsamples:									
	Verifiable Change	(3.3%)	(6.3%)	(4.2%)	(3.7%)	(4.4%)	(3.9%)	(3.9%)	(2.7%)	(1.7%)
	Nonverifiable Change	1.5%	0.4%	(0.1%)	(1.7%)	(2.7%)‡	(6.3%)**	(6.8%)**	(8.2%)**	(8.3%)*
	Verifiable Ongoing	(5.8%)	(16.1%)	(10.0%)	(7.6%)	(7.0%)	(6.6%)	(5.6%)	(5.6%)	(7.8%)
	Nonverifiable Ongoing	(4.1%)	(6.1%)*	(8.3%)**	(6.1%)*	(5.5%)*	(7.8%)**	(10.9%)**	(7.3%)**	(7.1%)**

Table 3.5 (Continued)

Panel C – Pearson (Spearman) correlation on the upper (lower) diagonal

N=809	ROS	GM	SGA Margin	Market Share	Herfindahl Index	# of Firms in Industry	Acquisition Indicator	Market Value
Abnormal Return on Sales (ROS)		0.474 ***	0.214 ***	0.086 *	–0.074 *	0.017	–0.027	0.247 ***
Abnormal Gross Margin (GM)	0.457 ***		–0.664 ***	–0.268 ***	–0.163 ***	0.204 ***	–0.052	–0.024
Abnormal Selling, General, and Administrative Margin (SGA Margin)	0.414 ***	–0.620 ***		0.347 ***	0.086 *	–0.172 ***	0.024	0.193 ***
Market Share	0.052	–0.132 ***	0.181 ***		0.633 ***	–0.799 ***	0.405 ***	0.488 ***
Herfindahl Index	–0.001	0.050	–0.052	0.487 ***		–0.804 ***	0.328 ***	0.001
# of Firms in Industry	0.057	0.150	–0.104 **	–0.348 ***	–0.581 ***		–0.351 ***	–0.045
Acquisition Indicator Variable	–0.024	–0.045	0.025	0.334 ***	0.254 ***	–0.308 ***		0.231 ***
Market Value of Equity	0.147 ***	–0.021	0.151 ***	0.227 ***	–0.031	–0.064 ‡	0.234 ***	

Variable Definitions (Calculations using Compustat data items in brackets):

Abnormal Return on Sales	Return on Sales [ebit/revt] adjusted by the 4-digit NAICS industry [naics] mean performance by firm-year.
Abnormal Gross Margin	Gross Margin [1 – cogs/revt] adjusted by the 4-digit NAICS industry [naics] mean performance by firm-year.
Abnormal Selling, General, and Administrative Margin	Selling, General, and Administrative Margin [(ebit + cogs)/revt] adjusted by the 4-digit NAICS industry [naics] mean performance by firm-year.
Market Share	As defined in Table 3.3.
Herfindahl Concentration Index	As defined in Table 3.3.
Number of Firms in NAICS4 Industry	As defined in Table 3.3.
Acquisition Indicator Variable	As defined in Table 3.3.
Market Value	The natural log of market value [mvalt] at the end of the fiscal period.

***, **, *, ‡ indicate statistical significance at $p<0.001$, $p<0.01$, $p<0.05$, and $p<0.10$ levels, respectively (2-tailed tests)

subsequent to disclosure and the verifiable ongoing firm subsample industry-adjusted ROS increases monotonically (with the exception of the 1st year). This provides support for the credibility of ongoing firms that provide verifiable detail and lack of credibility for change firms that do not. The other subsamples do not appear to have consistent performance trends. Bi-variate correlations reported in Panel C are generally consistent with those using the matched pair design (Table 3.3 Panel C).

Regression results (untabulated) reveal that hypothesis 3.1 is *not* supported using industry-adjusted performance measures. In fact, the change in positive abnormal ROS persistence is *less* for firms that provide verifiable detail than those that do *not* ($p<0.10$), providing support *against* hypothesis 3.1. In contrast, results support hypothesis 3.2 by reporting a greater change ($p<0.05$) in the persistence of positive abnormal ROS for ongoing firms that provide verifiable detail than ongoing firms that do not. Finally, results contradict hypothesis 3.3 by finding that change firms that provide verifiable detail have a *smaller* change in positive abnormal ROS than ongoing firms that provide verifiable detail.

It is possible that these contradictory results are due to over-weighting observations that have a full 9 years of available data relative to firms that do not. To illustrate, Table 3.5 Panel A shows that change firms that provide verifiable detail have significantly positive performance in the 1st year of the sample (4 years prior to disclosure), yet only 14 of the 18 firms are represented in that time period. Further analysis (untabulated) addresses this concern by applying the limited sample period (–2/+2 window) described in section the previous subsection using industry-mean adjusted

performance measures. Results using a –2/+2 window sample period support hypothesis 3.1 by reporting an increase in the persistence of abnormal GM for firms that provide verifiable detail relative to those that do not.

In summary, analysis using industry-adjusted performance as a proxy for abnormal performance supports the conclusion that verifiable detail provides credibility to customer retention strategy disclosure, particularly when the sample period is limited to a –2/+2 window in which all firms have the same number of observations.

Additional Analysis – Changes in the Levels of Abnormal Performance

Dickinson and Sommers (2008) document that BTE variables are positively associated with the *level* of future performance. This section uses increases in the level of future performance associated with disclosure as an alternative proxy for the validity of verifiable detail as a source of credibility. Firms that provide verifiable detail are expected to have greater changes in the level of abnormal performance than firms that do not. As explained in section 3.3, it is difficult to infer changes in the *level* of abnormal performance from the regression coefficients estimated using equation 3.2. This subsection provides an alternative form of analysis by comparing average pre- and postdisclosure levels of abnormal performance.

Table 3.6 provides average pre- and postdisclosure levels of abnormal performance. Each measure (ROS, GM and SGA Margin) is represented by a trio of columns. The third column for each measure reports the change in the level of performance from pre- to postdisclosure time periods. The first two rows report

Table 3.6

Analysis of Pre- and Postdisclosure Levels of Abnormal Performance

Mean	Abnormal ROS			Abnormal GM			Abnormal SGA Margin		
Subsamples:	Pre-	Post-	Change	Pre-	Post-	Change	Pre-	Post-	Change
Verifiable Change	(1.0%)	0.6%	1.5%	0.2%	0.4%	0.2%	(1.2%)	0.2%	1.4%
Nonverifiable Change	1.0%	(1.0%)	(2.0%)	(0.1%)	2.6%	2.7%	1.1%	(3.6%)	(4.7%)*
Difference			3.5%			(2.6%)			6.1%*
Subsamples:	Pre-	Post-	Change	Pre-	Post-	Change	Pre-	Post-	Change
Verifiable Ongoing	(1.5%)	(0.2%)	1.3%	(0.6%)	(1.0%)	(0.3%)	(0.9%)	0.7%	1.6%
Nonverifiable Ongoing	1.2%	(2.7%)	(3.9%)‡	2.3%	1.2%	(1.1%)	(1.1%)	(3.9%)	(2.8%)
Difference			5.2%			0.8%			4.4%

Predisclosure period includes up to 4 years prior to and including the disclosure year.
Postdisclosure period includes up to 4 years subsequent to the disclosure year.
Pre- and Postdisclosure abnormal performance measures are first averaged by firm and then averaged across subsamples to avoid biasing estimates towards firms that have 9 years of observations.
Statistical significance between groups calculated using group mean *t*-tests. Statistical significance within groups calculated using an expected value of zero.
***, **, *, ‡ indicate statistical significance at $p<0.001$, $p<0.01$, $p<0.05$, and $p<0.10$ levels, respectively (2-tailed tests)

performance for change firms that provide verifiable detail and change firms that do *not*. The second pair of rows reports performance for ongoing firms similarly separated by the presence of verifiable detail. The third row of each section reports differences in changes between verifiable detail and nonverifiable detail subsamples.

Change firms that provide verifiable detail increase the level of performance across all three performance measures. Although consistent across measures, the changes do not statistically differ from zero. In contrast, change firms that do *not* provide verifiable detail decrease SGA Margin performance at a statistically significant level ($p<0.05$). Finally, the change in SGA Margin for change firms that provide verifiable detail is statistically greater than the change in SGA Margin for firms that do *not* ($p<0.05$).

Ongoing firms that provide verifiable detail increase the level of performance using ROS and SGA Margin and show a small decrease using GM. However, the changes do not statistically differ from zero. In contrast, ongoing firms that do *not* provide verifiable detail decrease ROS at a statistically significant level ($p<0.10$) and report insignificant decreases in GM and SGA Margin. Finally, the change in the level of performance across all three performance measures is consistently greater for ongoing firms that provide verifiable detail than the change for ongoing firms that do not. However, the difference is not statistically significant using any single performance measure. In summary, the evidence using changes in the level of abnormal performance is generally consistent with verifiable detail as a source of credibility in customer retention disclosure.

Conclusion

This paper uses variation in the presence of verifiable detail provided in customer retention strategy disclosures to validate the credibility of nonfinancial disclosures. Specifically, it finds that firms that provide verifiable detail have a greater change in the persistence of positive abnormal performance than firms that do not. This contributes to the voluntary disclosure literature by providing evidence that verifiable detail is a source of credibility to nonfinancial disclosure, using a setting where credibility can be measured by theory-supported realizations of future performance.

These results should be of value to accounting researchers and market participants interested in the credibility of voluntary disclosure. The results of this study suggest that credibility through ex post verification is not limited to accounting measures reported on audited financial statements. Detailed nonfinancial statements that relate to observable strategy can also provide credibility.

This study has a significant limitation in that it uses a single disclosure setting to evaluate the credibility of nonfinancial disclosure through the use of verifiable detail. The usefulness and availability of verifiable detail may vary substantially across nonfinancial disclosure settings. For example, firms may disclose employee retention programs that create a barrier to entry (potential competitors must incur employee development costs to enter a market). However, disclosed implementation details may be more difficult to verify than those relating to customer retention programs. In contrast, a firm may disclose strategic partnerships. However, the disclosure may not provide any information because the partnerships are transparent to competitors and investors. The variation in

nonfinancial disclosure settings provides a vast landscape for future research.

Appendix

The following examples are actual customer retention disclosures included in 10-K filings from each subsample:

Verifiable Change Firms

Apple Inc. provides the following reference to customer retention strategy in its fiscal year 2004 10-K filing:

> The Company believes a high quality buying experience with knowledgeable salespersons… is critical to attracting and retaining customers. As such, … the Company has expected its product distribution strategy to include… the Apple Sales Consultant Program.

This is coded as a *change* in customer retention strategy with a *high* level of verifiable detail. The Apple Sales Consultant program can be verified by parties external to the firm.

Popular, Inc. provides the following reference to customer retention strategy in its fiscal year 2002 10-K filing:

> In April 2002, BPPR launched the new PREMIA rewards program. This is a unique customer-loyalty program designed to compensate its customers for their banking relationships. The program allows customers of BPPR and of the Corporation's subsidiaries in Puerto Rico to enroll and accumulate points for everyday financial transactions and from a variety of products and services, including deposit accounts, credit cards, mortgage and auto loans, and electronic services transactions, among others. The points accumulated are redeemable for airline tickets, merchandise and prepaid ATM cards, among other alternatives.

This is coded a *change* in customer retention strategy with a *high* level of verifiable detail. The loyalty program can be verified by parties external to the firm.

Gannett Co., Inc. provides the following reference to an acquisition designed to enhance customer retention in its fiscal year 2003 10-K filing:

> On Oct. 31, 2003, the company acquired the assets of Clipper Magazine, Inc., one of the nation's largest direct-mail advertising magazine companies. The acquisition also includes several affiliated operations including a full-service advertising agency, an e-mail customer retention service, a direct-mail service to new movers and MyClipper.com, a companion Web site for the core direct-mail advertising offerings.

This disclosure is coded a *change* in customer retention strategy with a *high* level of verifiable detail. The reference describes an acquisition that can be easily verified.

CVS Caremark Corporation provides the following reference to customer retention strategy in its fiscal year 2000 10-K filing. Note that this disclosure references customer retention in the context of a broader barrier to entry strategy including business partner and employee relationships:

> We are currently beginning the chain wide rollout of our new relationship marketing program, the ExtraCare Card. Through the ExtraCare card, we will offer special promotions and incentives to our best customers to reward their patronage and encourage increased loyalty.

This is coded a *change* in customer retention strategy with a *high* level of verifiable detail. The ExtraCare card can be easily verified by parties external to the firm.

Nonverifiable Change Firms

Banta Corp. provides the following reference to customer retention strategy in its fiscal year 2001 10-K filing:

> Through a targeted sales effort to maintain a high customer retention rate, Banta partially offset the impact of business-to-business biennial catalogs not being printed.

This is coded a *change* in customer retention strategy with a *low* level of verifiable detail. There is no implementation detail provided.

Countrywide Financial Corporation provides the following reference to customer retention strategy in its fiscal year 2002 10-K filing. Note that this disclosure references customer retention in the context of a broader barrier to entry strategy including business partner and employee relationships:

> The Company's relationship management initiative utilizes a combination of internally developed tools, together with Microsoft and Siebel web-based tools, to create a platform for managing all relationships. The Company's goal is to provide customers, business partners and employees with online access to all of the available tools, resources and information they need through a web portal [countrywide.com, CWInsider.com, Sales Force Automation].

This is coded a *change* in customer retention strategy with a *low* level of verifiable detail. The strategy references web portal relationships with suppliers and customers, which are difficult to verify unless you are a supplier or customer.

US Bancorp provides the following reference to customer retention strategy in its fiscal year 2004 10-K filing:

> The [decrease in business-related noninterest-bearing deposits] also included certain product changes to migrate high-value customers with balances of $1.3 billion to the Company's Silver Elite interest checking product to further enhance customer retention.

This is coded a *change* in customer retention strategy with a *low* level of verifiable detail. The strategy references the migration of high-value customers to interest-bearing accounts, which are difficult to verify unless you are a high-value customer.

Leucadia National Corporation provides the following reference to customer retention strategy in its fiscal year 2004 10-K filing:

> During 2004, Symphony performed an evaluation of its customer base, in order to identify those customer and markets where Symphony can deliver the highest level of service and that should be the focus of customer retention efforts, as well as identifying those customers that should be terminated. In addition, Symphony has restructured its corporate management and field operations organization, resulting in a more efficient organization with reduced costs. Symphony is also seeking to grow its profitable businesses, which includes expanding its service offerings to existing customers.

This is coded a *change* in customer retention strategy with a *low* level of verifiable detail. The strategy references a push to identify and serve profitable customers, which is difficult to verify by parties external to the firm.

Verifiable Ongoing Firms

Citigroup Inc. provides the following reference to maintaining focus on increasing customer retention in its fiscal year 2001 10-K filing:

> [In 2001], Citibanking invested in programs and staff to improve operations and customer service while continuing to control overall expenses. In addition, Citibank continues to emphasize its needs-based sales approach through Citipro, a complimentary financial analysis that assess customers' needs and recommends appropriate financial products to meet those needs. The key elements to grow our earnings will be increasing sales productivity in the Financial Centers; increasing customer retention through focused marketing, cross selling and technology; streamlining processes and investing in appropriate technology to improve productivity and cost efficiency, which, in turn, will enhance price flexibility; and improving customer service and satisfaction.

This is coded an *ongoing* customer retention strategy with a *high* level of verifiable detail. The reference describes 'Citipro,' a program to "assess customers' needs" that *can* be verified by parties external to the firm.

Hughes Supply, Inc. provides the following reference to customer retention strategy in its fiscal year 2004 10-K filing:

> The key elements of our strategy are to: … buy, operate and sell as one integrated, streamlined organization. Specific actions taken or to be taken include the following: … The continued execution of best-in-class marketing programs, targeting both customers and vendors, which are designed to build on the Hughes brand name, to increase incremental revenues, improve customer retention and enhance business relationships across the supply chain.
>
> Our marketing programs build Hughes brand awareness and bring value to the supply chain by helping our vendors market and sell their products to a broad customer base. We are continuing to execute our best-in-class marketing programs, and we believe the following marketing materials and programs are unparalleled in our industry and differentiate us from our competitors: The creation of best-in-class promotional product brochures that provide our sales force with the tools they need to increase sales, while providing our vendors with an opportunity to participate in our comprehensive targeted sales program; The production of comprehensive product line catalogs with color photos that showcase vendors' products and facilitate routine ordering for customers; Unrivaled customer awards programs that drive incremental sales and build customer loyalty; and The hosting of themed marketing events throughout our major markets attended by thousands of our customers, which provides us with the opportunity to show customer appreciation while allowing our vendors to showcase their quality products.

This disclosure is coded an *ongoing* customer retention strategy with a *high* level of verifiable detail. The reference describes specific marketing programs (product brochures, catalogs, customer awards programs, themed marketing events) that can be observed by parties external to the firm.

The Midland Company provides the following reference to customer retention strategy in its fiscal year 2003 10-K filing:

> Attracting good customers and keeping them for the long haul is critical. Product, price, service and convenience all play crucial roles in customer retention and conversion. Through American Modern, we've leveraged all four to achieve high customer retention rates for a specialty lines insurer. Our strong customer relationships are the result of our ability to provide a distinctive mix of exceptional service, competitive pricing and specialized products that customers cannot readily find elsewhere.

This disclosure is coded an *ongoing* customer retention strategy with a *high* level of verifiable detail. The disclosure references product mix and pricing relative to competitors, which can be verified by parties external to the firm.

KB Home provides the following reference to customer retention strategy in its fiscal year 2003 10-K filing:

> Our division personnel provide assistance to homebuyers during all phases of the homebuying process and after the home is sold. The coordinated efforts of sales representatives, KB Home Studio consultants, on-site construction superintendents and postclosing customer service personnel in the customer's homebuying experience is intended to provide high levels of customer satisfaction and lead to enhanced customer retention and referrals. In our domestic homebuilding operations, we provide customers with a limited home warranty program administered by personnel in each of our divisions. This arrangement is designed to give our customers prompt and efficient postdelivery service directly from KB Home.

This disclosure is coded an *ongoing* customer retention strategy with a *high* level of verifiable detail. The 'limited home warranty' program is easily verified by parties external to the firm.

Nonverifiable Ongoing Firms

American Medical Alert Corp. provides the following reference to customer retention strategy in its fiscal year 2006 10-K filing:

> While the Company generates organic growth in each reporting segment, customer retention is equally important. The Company's customer service, provider relations and accounts services team focuses on account management and business development from existing customers.

This disclosure is coded an *ongoing* customer retention strategy with a *low* level of verifiable detail. The disclosure references 'focus on account management,' which cannot

be verified by parties external to the firm.

AmSouth Bancorporation provides the following reference to customer retention strategy in its fiscal year 2003 10-K filing:

> The new strategic initiatives are similar to the initiatives AmSouth has emphasized since 2000. They include: … Enhance sales productivity, service quality and customer retention.

This disclosure is coded an *ongoing* customer retention strategy with a *low* level of verifiable detail. There are no implementation details to verify.

Ball Corporation provides the following reference to long-term customer relationships in its fiscal year 2004 10-K filing:

> We sell our packaging products primarily to major beverage and food producers with which we have developed long-term customer relationships. This is evidenced by our high customer retention and our large number of long-term supply contracts.

This is coded an *ongoing* customer retention strategy with a *low* level of verifiable detail. The reference implies that there has been an effort to "develop long-term customer relationships." However, 'high' customer retention and a 'large number' of long-term supply contracts cannot be easily verified by parties external to the firm.

Ceridian Corporation provides the following reference to customer retention in its fiscal year 2003 10-K filing:

> Customer retention is an important factor in the amount and predictability of revenue and profits in our HRS businesses. In providing some of our services, particularly payroll processing and tax filing services, we incur installation and conversion costs in connection with new customers that need to be recovered before the contractual relationships will provide incremental profit. The length of time it takes for a contract to become profitable depends on a number of factors such as the number of employees covered by the contract, the complexity of the services involved, the amount of customization of services required and the

> number of locations in which the customer's employees are located. The longer we are able to retain a customer, the more profitable the contract will likely be.
>
> We have ongoing and continued initiatives to invest in and improve the performance of our U.S. HRS business. These initiatives include: … improving our customer service model, improving customer retention…
>
> The most significant source of customer leads for these [HRS] transaction-based products and services are referrals from these marketing relationships and existing customers, and other direct marketing efforts, such as telemarketing, direct mail and trade shows…. We are also seeking to further integrate and coordinate the sales and marketing efforts of our businesses and to sell a greater variety of our products and services to the customers of our various businesses.

This disclosure emphasizes the importance of customer retention in creating profit. However, it is coded an *ongoing* customer retention strategy with a *low* level of verifiable detail. The reference describes "ongoing and continued initiatives" relating to customer retention. The only detail provided relates to coordination between businesses to enhance cross-selling opportunities.

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CONCLUSION

My dissertation is comprised of three independent papers. The first paper (Chapter 1) is co-authored with Taylor Randall and Christian Terwiesch. In it, we examine the predictive associations between operations based variables and future earnings using data from the United States Air Transportation industry. We find that some operations based variables contain incremental predictive information beyond that provided by earnings components. Additionally, we find that the operations based variables that convey predictive information are different before and after the September 11, 2001 terroristic attacks. Finally, we find that financial analysts do not fully impound the information provided by operations based variables after the terroristic attacks.

The second paper (Chapter 2) also uses United States Air Transportation industry data. In it, I provide evidence that sticky costs are associated with increasing marginal cost and decreasing marginal benefit as management adjusts capacity levels. I also find that sticky costs are associated with changing output selling prices, consistent with management using price changes to adjust sales volume to match capacity. These determinants add to the explanation offered by the extant literature that sticky costs arise from managers' retention of unused resources as demand falls.

The third paper (Chapter 3) establishes the validity of verifiable detail as a source of credibility in nonfinancial strategy disclosure. I form expectations regarding outcome associated with credible nonfinancial strategy disclosure using customer retention theory. I then test whether customer retention strategy disclosures containing verifiable detail are associated with ex post outcome consistent with theory. I find that ex post outcome of firms that provide verifiable detail in their disclosures is more consistent with theory than outcome of firms that do not. This empirical evidence supports verifiable detail as a valid source of credibility in customer retention strategy disclosure.